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EXPORT TRADE.

"Small by degrees and beautifully less" is a phrase that might well be applied to the exports of electrical goods from the United States during the past year. It is well to cultivate optimism, but the strain is rather severe when everything justifies a pessimistic trend of thought. Only a Mark Tapley could revel in riotous cheerfulness over such statistics as apply to electrical exports lately, and, so far as we are aware, there are not many Mark Tapleys in the business. It is now evident that 1909 is likely to fall far below both of the two years preceding. The exports of electrical instruments for April show a value of $490,483 as compared with $586,427, and a total of $4,940,397 for 10 months, as compared with $5,808,371 in 1908 and $6,888,971 in 1907. In heavy electrical machinery the same decline is to be noted. The value in April was $489,026 as compared with $566,586 a year ago, while the 10 months' figures are $5,302,122 as compared with $7,366,634 in 1908 and $7,124,240 in 1907. Our best customers have had apparently neither the money nor the inclination to buy, and it will be interesting to see how soon and how far the new revival of electrical industry in this country, as marked by our Convention issue last week, will carry them over and away from the present "dead center" of depression and relaxed demand.

THE ELECTRIC LIGHT CONVENTION.

The convention at Atlantic City of the National Electric Light Association is now in full swing as we go to press, and will continue in session throughout the week. A portion of the proceedings is given in this issue, the remainder to appear in the next. The program this year is most extensive in character, few if any topics of interest and importance being omitted. The usefulness of the meeting will depend, however, to a large extent on the discussions, bringing out many latent ideas and suggestions of value, while, as every old conventioner knows, that which he learns outside the meeting room is often of more benefit to him than either papers or discussions. Fortunately, there is very little that the association cannot treat "out in the open," and in reality the more information the public can be given of the work of such a body, the more cordial is its appreciation of the earnestness of purpose that animates the men seeking to supply the necessities of the country in regard to electric light and power.

As to the actual work, it is evident that the association is attempting a good deal, but it may be taken for granted that what is planned will be, if possible, accomplished, and that one more impress for good will be left on the industry. The social atmosphere of such an occasion is as perceptible as the ozone in the breezes off the Atlantic, but the real motive of assemblage is the diffusion of knowledge and the stimulus

derived from one's associates. In this respect the convention of 1909 bids fair to equal, if not surpass, any of its predecessors. The association will soon be celebrating its first quarter of a century, and is to be congratulated on having "made good" in a most emphatic manner in that term of years.

Low-Voltage Tungsten Lamps.

We have from time to time referred to the experiments which have been made in central-station practice with tungsten lamps worked at 30 volts to 60 volts. Trials of this sort have not been very numerous, the great bulk of all tungstens being for the usual pressures of 110 volts to 120 volts. To work at the lower voltages means either lamps in series or the use of alternating current with tertiary transformation. The former proposition is not a very practical one save for occasional cases, so that interest centers practically upon the use of low-voltage lamps worked off auto-transformers or their equivalent. On general principles, to lower the distributing voltage is a step backward, but this particular service relates at present chiefly to interior wiring already established, which is a somewhat different matter since at, say, 60 volts, the current demanded by the tungsten lamps is enough less than that for which the wiring was planned to compensate for the less voltage. The 30-volt plan seems at least temporarily bad on account of the lack of fan motors and other useful appliances for so low a voltage. At 50 volts to 60 volts, however, this objection does not hold, and the real issue is the gain possible in using the lower-voltage lamps. As a matter of experience, the thicker filament of the low-voltage lamp gives a material improvement in life, and, what is of more importance from the standpoint of domestic lighting, enables one to get an efficient and durable lamp of 10 cp or 12 cp.

The weakest point of central-station work is domestic lighting, which has by default gone largely into the hands of the gas men. The electric light man too often turns down these small consumers almost with contempt, while the latter gives them a welcome and pays his dividends with the proceeds. The low-voltage, low candle-power, high-efficiency lamp may be of material help in dealing with gas competition among small consumers if it is intelligently applied. Of course, there is some loss of energy in the tertiary transformation, enough perhaps to deter the larger consumers who are earning good discounts. The small user generally pays the maximum rate and can afford to waste a little energy in transformation if thereby he can get high-efficiency lamps without heavy depreciation. At low voltage a practical and durable 15-watt lamp can be had, while the larger sizes are of still sturdier qualities. For the sake of these, the small user can well afford 15 watts or 20 watts loss in his house transformer. But how about the central station? In the first place, it is quite certain that its regulation would suffer seriously if a big load with tertiary transformation should grow up. Second, the bills of many small consumers would be cut dangerously near to the non-paying point. As to the former count, a big load of this sort can be prevented. As to the second, it is certainly up to the central station to devise some method for taking care of the small consumer that will involve less fixed charges than at present. One point often forgotten is that domestic lighting is for the most part after the peak and should not be treated like the commercial peak load in reckoning costs of service. Another is that gas companies have the problem of the small consumer always with them and make its solution pay. It looks dubious to us whether the low-voltage tungsten lamp is more than a passing phase of growth, but it certainly seems to have a value in dealing with the small consumer if his patronage is of value to the central stations, as it is to the gas companies.

Elementary Illumination Calculations.

If the work of the illuminating engineer is to be maintained above the level of mere empiricism, it must be carried on by, and through the medium of, photometric measurements, in order that specifications for illumination may be intelligently prepared by the owners of the building, may be definitely complied with by the constructors, and may be certified to by inspection at the completion of the building. The engineering computations involved in such specifications must not only be accepted by illuminating engineers as scientifically correct, within a satisfactory degree of precision, but they must also be reasonably simple. It is of no use having technical facts within the scope of mathematical formulas, if these formulas are so long, complex or laborious that they cannot be applied by the engineer in his daily work. If a navigating officer, on shipboard, had to spend three hours in hard computation over his noon sights, in order to work out his latitude, instead of the minute or two ordinarily so occupied, noon sights would be honored more in the breach than in the observance. Applied science always had two aims in view simultaneously—first, to keep square with pure science, so as not to go adrift into error, and second, to make the mathematical work as easy and swift as possible.

The article by Mr. N. Whitney, printed elsewhere, presents some facts known to illuminating engineers in a compact form, for the use of those who are not familiar with recent practice in the predetermination of horizontal illumination, by lamps of given photometric data, supported in rooms of given dimensions. There are three main types of indoor artificial illumination in general demand, and they are often confused or not clearly separated in the apprehension of illuminating engineering students. These are respectively discernment illumination, æsthetic illumination, and illumination for scrutiny. Discernment illumination is illumination merely for the purpose of finding one's way, without colliding with persons or things in the vicinity. It would be represented specifically by the illumination required in a hallway, or a corridor with terminal doors. Æsthetic illumination is illumination for the purpose not merely of avoiding obstacles, but also for pleasing the eye, as, for instance, the illumination in a reception room. Illumination for scrutiny is either illumination for reading, writing, draughting or minute examination at short range, or for careful examination of objects at long range, as on the stage of a theater. It is characteristic of discernment illumination that it can be of relatively very feeble intensity with comfort, and certainly with economy. Moonlight intensity is often quite sufficient out of doors, and illuminations of from one-thousandth to one-tenth of a foot-candle, preferably in yellowish light, are commonly sufficient indoors. Æsthetic illumination is characterized by a careful selection both of intensities and colors of illumination. Considerably greater ranges in both are called

for than in mere discernment illumination. The intensities may run from one-thousandth of a foot-candle up to a foot-candle or more. In this direction, æsthetic taste is often of greater importance than engineering knowledge. Illumination for scrutiny requires much greater intensity of illumination than either of the other types. From one to five foot-candles, for short-range work, is commonly demanded.

In all types of illumination, the brightness of the light-sources directly exposed to the retina ought not to exceed one or two candles per square inch. Reading rooms of all kinds naturally require illumination for scrutiny over a considerable area and thus need a large average illumination. It is for such rooms, in particular, that the formulas of Mr. Whitney's paper are most generally required. In æsthetic illumination, and particularly in discernment illumination, less care is needed in assigning light sources according to formulas. Furthermore, in the use of carbon-filament incandescent lamps, it is customary to assume that after they have fallen off in candle-power to a certain degree, it pays to smash and replace them by new lamps. That philosophy is sound enough in many cases of illumination for scrutiny, but the doctrine of the axe is often sheer heresy when applied to æsthetic illumination or particularly to discernment illumination. A lamp in a hallway may be blackened by age so far that it gives only half its original candle-power. As a source of lumens per dollar it has become very expensive by comparison with its primitive lighting power. But if it still gives enough light to go about by without discomfort, it is waste of money to smash the lamp. When, however, a renewal is finally made, it might be worth while considering the insertion of a lamp of smaller candle-power, with less excess over actually needed illumination. Such a renewal may involve a smashing point when the new illumination shall have fallen off uncomfortably. The doctrines of the smashing point and of uniform illumination all over the floor of a room must both be taken with limitations, and both call for precision in the original installation of the lamps.

Concerning Technical Libraries.

With all the present interests in library organization and administration it ought to be possible to increase greatly their usefulness to technical students. Every institution of learning, to be sure, has its own library, more or less extensive and available. Certain lines of technical reference books and periodicals have, of course, to be duplicated in all libraries of any pretensions, but it is impossible for any university library to cover the whole range of periodicals in science and technology without very great expense. Many sets, especially of long-established papers, are very costly, and as found in libraries in general are rarely complete. It seems hardly necessary that such sets should be duplicated in neighboring libraries, and yet, as a rule, the federation of libraries is not carried far enough to make all the resources of a given city available for the very investigators who need them most and could make the best use of them. Consider for a moment the actual process of running down the bibliography of a single small topic, the difficulty of which is hardly realized save by those who have tried it. One starts commonly with the references in standard books, and looking up the monographs mentioned, perhaps nominally on topics remote from the thing in hand, goes on from references in these to still others, always in three languages, sometimes in half a dozen. The number of references runs up in a sort of geometrical progression—an endless chain of references covering 50 years or more of time. The common books and periodicals are soon exhausted, and then the real trouble begins, and the library difficulty enters.

Many scientific writers are slovenly in their references, and one often is confronted by things like: "As Stiggins has shown in his early monograph before the Philosophical Society of Benares," etc. The first thing is to find out where the proceedings, if any, of this organization are to be found. A search through the available indices may locate the set in the files of a quasi-private incorporated library; then comes the unwinding of the red tape to get access to the library, and once there, one usually has to drag the whole set into the reading-room and go through it, the stacks being, of course, closed. Very likely at the end it is found that the paper has been printed only in abstract. And so the chase goes on. If the reference is definite, an inter-library loan may simplify things, since most civilized libraries take part in inter-library loans; but this device is futile in the common case of having to share blind references through sets. Now, by proper co-operation it should be possible to cut short the labor in such instances. In the first place, all well-organized libraries should have their sets of technical periodicals listed in a printed list, noting in each case any gaps that may exist. Such lists should be exchanged between libraries, indexed and kept up to date, so that the references, so far as material is concerned, can be quickly located. Of course, there are such lists to-day, but they are not kept sharply up, and the matter of gaps is not taken care of as it would be if the lists of each library were periodically revised and kept up to date. The next step is to secure the maximum of accessibility. Why should not the strictly scientific and technical sets of periodicals in a library be located in a special reference room to which prompt access can be had by those who need it? Most libraries are liberal in their policies toward scholars, but the stack is, for obvious reasons, carefully guarded. A technical reference room is not a place likely to be frequented save by those who are there for business, and it would there be possible to run down in an hour references that would require a day, and the handling by the library staff of half a ton of books, if the consultation were done in the ordinary way.

With indexing well kept up and the literature made accessible in this simple way, one could locate the library needed and run down his subject in very much less time than is now possible. We could mention libraries where bound sets of periodicals on kindred technical subjects are scattered over three different departments of the library, some accessible easily and others with difficulty and requiring not a little preliminary labor to locate them at all. An apparently simple electrical problem is not necessarily confined to electrical periodicals in its references, so that the practice somewhat in vogue of encouraging certain libraries to specialize on certain subjects does not always work well. Close indexing of technical sources and quick availability of the materials are the things most necessary to give the investigator his best opportunity. A great mass of needless work is done every year merely on account of the difficulty of getting quickly at the published work of others on the same subject.

The Atlantic City Convention.

By Telegraph.

FOLLOWING a year of remarkable growth, the thirty-second convention of the National Electric Light Association begun here this (Tuesday) morning gives every indication of being a worthy culmination of the year's efforts. All meetings are held on the new Million-Dollar Pier of steel and concrete. As one enters this huge structure from the Boardwalk, he passes between the registration bureau and secretary's office. Directly in front of him is a large open space which during the daytime is fitted with easy chairs and rugs for a lounging place. In the evening this space may be cleared for dancing. Grouped about are the exhibits of electrical apparatus and further seaward on the pier, is the meeting hall where the session of this morning was held.

The exhibition hall is a large and lofty apartment with arched ceiling studded with incandescent lights of various colors. Several designs are worked out in the overhead lamps, including a waving American flag and eagles with flapping wings. Opposite the main entrance, over a balcony where the well-known Filipino band is stationed, are several vaulted recesses, and the lamp designs in these were particularly tasteful and effective. Flaming arcs and large electric signs make the exterior of the pier conspicuous at night. A brilliant scene was presented at the exhibition hall last (Monday) evening, when the exhibits of associated members were formally opened for inspection.

Following the opening of the exhibition there was a reception by the officers of the association to delegates and visitors. In the receiving line were Mr. and Mrs. Joseph B. McCall, of Philadelphia; President W. C. L. Eglin and Miss Eglin, of Philadelphia; Mr. and Mrs. W. W. Freeman, of Brooklyn; Mr. Frank W. Frueauff, of Denver; Mr. John F. Gilchrist, of Chicago, and Miss Harriet Billings, of New York. Mr. McCall was chairman of the reception committee and Mr. Frank H. Gale, of Schenectady, of the exhibition committee. Dancing followed the reception and the lights, the music, the handsomely gowned ladies and the less conspicuous men, with the setting of attractive exhibits, formed a pleasing ensemble.

In point of attendance it is impossible at this writing to make an accurate forecast other than that it will be very large. Before the convention opened this (Tuesday) morning, the number of persons registered as in attandance had reached 900, and this number will be doubled no doubt before the concluding session of Friday. The advance registration reached 1350, whereas at no preceding convention has this figure exceeded 1000.

President W. C. L. Eglin, of Philadelphia, opened the first session on Tuesday morning promptly and introduced Mayor Stoy, of Atlantic City, who bade the convention welcome. The Mayor said he realized the great importance of electric illumination, which has done much to make Atlantic City what it is. His greeting, therefore, was particularly cordial. On motion of Mr. McCall a vote of thanks was extended to the Mayor.

President Eglin then delivered the annual presidential address, which was followed with close attention by the large number of members who were present.

The address was largely devoted to matters relating to the routine work and organization of the association. Referring to the State and company branches, he said that during the past year three of the former and 22 of the latter have been established. There had been some feeling among members of existing State organizations that these bodies might lose their identity and importance if they became affiliated with the association, but this feeling, Mr. Eglin believed, will undoubtedly rapidly disappear when there is a fuller knowledge and a better appreciation of the aim of affiliation. Standardization of methods and authoritative opinion are much to be desired, and although State associations are doing good work, they cannot recommend standards that will be adopted universally unless they have been approved by a national organization. To produce best results along these lines, it appears logical that as early as practicable all of the present State electric light organizations should become affiliated with the national body representing the electric light industry.

Experience gained during the past year seems to indicate that the company sections develop keen interest in the work of the association and materially increase the value of its *Proceedings*, while they enable a very large percentage of the employees of the member company to benefit from the work of the national body. A company branch enables all of the departments of the company to come together on a common ground, it assists in reducing all friction between the different departments and materially develops the men through an interchange of thought and ideas in the presentation and the discussions of papers. Four of the company branches issue *Bulletins* as a vehicle for general company news, and these mediums should do much in encouraging the ambitious employee. It is expected that many other company sections will be organized during the coming year.

Mr. Eglin expressed his strong belief in the success of the policy of having geographical and State sections wherever they can be supported. The smaller companies cannot afford to send representatives to conventions of the N. E. L. A. when far removed from their locality, while the State associations, with local officers known to the membership, interest them, and such members can materially assist in the work of the national association. For example, the chairman of committees of such bodies may serve as members of similar committees of the national association, with advantage to both sides. Moreover, through co-operation much duplication of work may be avoided, and certain routine work can be centered in the headquarters of the association, as a permanent staff there will be much more efficient than the work of numerous staffs not permanent in their personnel and scattered throughout the country.

Referring to the matter of income, Mr. Eglin stated that the revenue of the association at the present time is approximately $30,000, and that while this, with careful management, has been sufficient for usual current expenses, it is not enough to take care of the extraordinary expenses entailed at conventions, which latter have been provided for from a special fund which the membership subscribes each year for the purpose, and which amounts usually to between $10,000 and $12,000. A finance committee has been appointed to give special attention to the allotment of money available, to checking up various expenditures during the year, to see that the moneys of the association are properly invested and safeguarded and to building up the financial responsibility of the association. This committee should be a permanent sub-committee of the executive committee, and appointed promptly by each incoming ad-

ministration. Reference was made to the library for the association, which has recently been started and which, it is hoped, will develop into a reference library of great value to the members. There are many books, pamphlets and periodicals which may not be of much present value to members but which would be highly prized by the library. Donations to the collection will be highly welcomed, and in particular the library should contain complete files of the monthly *Bulletins* published by various member companies, since these have not only a historical value, but will be of benefit to members whose companies are considering the advisability of issuing publications of this class. Reference was made to the completion of a central station solicitor's handbook based upon manuscripts received in a prize competition instituted by the Co-operative Electrical Development Association. A copy of this will be given to each member of the association, and a limited number has been reserved for sale.

Taking up the subject of the Question Box, which is at the present time published in the monthly *Bulletin* of the association, President Eglin stated that as the result of a conference with Mr. Alex. J. Campbell and Mr. Paul Lupke, each of whom has had much experience as editor of the Question Box, a plan was devised to improve its value. The headings have all been rearranged, and a large number of sub-editors appointed corresponding to the various departments covered, to whom will be submitted all the questions and answers now in hand. The revised Question Box will be issued in loose-leaf form, convenient for filing or binding.

On motion of Mr. Dudley Farrand, of New York, Mr. Eglin's address and its recommendation were referred to a committee, which was appointed by the secretary of the association, Mr. John F. Gilchrist, of Chicago. This committee consists of Messrs. H. L. Doherty, of New York; C. L. Edgar, of Boston, and W. W. Freeman, of Brooklyn.

The report of the committee on uniform accounting was presented by Mr. H. M. Edwards, of New York. The committee points out and discusses briefly the differences between the sandard system of accounts of the association and the system prescribed by the New York Public Service Commissions. The report also presents, with the recommendation of the committee that it be adopted, a classification of construction expenditures. In presenting his printed report Mr. Edwards took occasion to compliment in cordial terms the classification of accounts adopted by the Wisconsin Railroad Commission. The discussion of the report will come up in accounting session on Thursday morning.

In the absence of the editor of the Question Box, Mr. Alex. J. Campbell, of New London, Conn, the printed report on this subject was read by Secretary Gilchrist. Mr. Campbell stated that the policy hereafter in conducting the Question Box would be to make it appeal rather to the small than the large companies, as the latter have on their staff specialists to consider the various problems that develop; and that answers to queries would be solicited from a larger number of members than in the past. During the year the sections of the Question Box which have appeared in the *Bulletin* will be revised, new material added and the whole printed in loose-leaf form properly numbered and indexed. From time to time pages in the handbook thus formed can be withdrawn and new sheets substituted, thereby keeping the information up-to-date. The next subject brought up was one of general interest and national importance, relating to the conservation of natural resources. Mr. Dudley Farrand, of Newark, N. J., who is the representative of the association on the National Conservation Commission, appointed as the result of the great interest of Theodore Roosevelt in this subject, submitted a report reviewing the progress of the movement and pointing out the importance and practical relation which this subject bears to companies supplying electric service.

He said that President Taft is heartily in favor of the movement and that although the work is at present carried on by private funds, it is probable that Congress will make an appropriation to defray the expenses of the continued investigation of this great problem. Mr. T. C. Martin, of New York, presented his annual report on progress in abstract. The printed report is a document of 64 pages replete with data relating to the advance of the art during the year, both at home and abroad.

After a general summary, sections of the report are devoted to regulations and rates, public service commission legal decisions, conservation of resources, municipal ownership, recent advances in plant design, special street lighting, metallic-filament lamps, flaming arcs and other illuminants, current-selling methods, electrical automobiles, artificial refrigeration, electric heating and cooking, measures for public safety, dealing with contractors and welfare work for contract station employee. Mr. Paul Lupke, of Trenton, N. J., contributed one of his characteristic "Human Interest" papers, the title being "Private Policy." Mr. Martin read the paper, and Mr. Lupke's practical suggestions and lively sallies were received with laughter as well as applause. Mr. R. M. Searle, of Rochester, N. Y., presented the reports of the committee on State and company branches and soon thereafter the convention adjourned until evening.

General, technical, commercial and accounting sessions constitute the four classes of meetings into which the convention of 1909 is divided. To-night (Tuesday) there will be a second general session, with morning and evening general sessions on Wednesday. Technical sessions will be held on Thursday morning and afternoon, commercial sessions on Thursday morning, Thursday afternoon, Friday morning and Friday afternoon, while there will be accounting sessions on Thursday morning and afternoon. Thus there will be three simultaneous sessions on Thursday.

In his address President Eglin announced one feature of the convention of unusual interest. This is the promised address of President Frank A. Vanderlip, of the National City Bank of New York, on Wednesday, the subject of which will be "Electrical Securities." Mr. Vanderlip will meet some of the prominent members of the association at a dinner to be given early Wednesday evening by Mr. Eglin. It is stated that Messrs. C. A. Coffin, A. N. Brady, Chas. L. Edgar, Samuel Insull and possibly George Westinghouse will also be Mr. Eglin's guests at the dinner. Mr. Vanderlip is familiar with many features of electrical development and he will touch on the magnitude, stability and growth of investment in the electrical field. Among the entertainment features the championship baseball game between the "Eastern Electrifiers" and the "Western Winners" on Wednesday afternoon is looked forward to with the keenest interest.

New York Convention Special.

The New York special train of parlor cars left the Pennsylvania Railroad depot at Jersey City on Monday at 10:15 a. m. and arrived promptly at sea level at 1:05. Including the party from Boston, no fewer than 160 delegates and friends were on board. Mr. George F. Porter, master of transportation, was present to superintend matters, and while the train was on its way he received news of the Chicago special and its safe arrival an hour or two ahead of the Eastern contingent. En route a number of conventionees were picked up at Newark. As a matter of fact, a large number of attendants from cities along the Atlantic Coast had gone on ahead, taking advantage of the double holiday, but Mr. Porter was very much gratified at the appreciation shown of the facilities afforded by the special on a crowded public holiday.

Past-President C. R. Huntley, his son Walter and De Lancey Rankine, of the Niagara Falls Power Company, started from Buffalo on an automobile trip to Atlantic City, judging all the conditions favorable at this beautiful season of the year. Everything looked promising for a safe and speedy run, but at Canandaigua they had the misfortune to lose a front wheel. Happily no one was hurt, and nothing daunted, the party pursued its way, arriving in good time for all that was going forward of importance.

Some idea of the interest taken in the convention may be formed from the fact that the Public Service Corporation of New Jersey began the week with 40 of its staff in attendance and will have no fewer than 200 present while the convention is in session.

New England Delegation to N. E. L. A. Convention.

The New England delegation to the Atlantic City convention of the National Electric Light Association left Boston at 6 o'clock Sunday evening in special parlor cars attached to the Fall River line train for New York, under the management of Mr. Charles H. Hodskinson, of the Edison Electric Illuminating Company of Boston, master of transportation for New England. The party consisted of a total of 73 delegates, including a number of ladies.

At Fall River the delegation embarked for New York on the steamship *Commonwealth,* arriving at the Hudson River pier Monday morning. They were transferred to the Jersey City terminal of the Pennsylvania Railroad by the special annex ferryboat *Baltimore,* and left by special train with the New York delegation for Atlantic City at 9:55, arriving at 1:05 p. m. Several delegates also made the journey by other routes. The delegation included the following:

Adams, F. D., Bridgeport Electric Light Co., Bridgeport, Conn.
Mrs. F. D. Adams, Bridgeport, Conn.
Ayer, J. I., Simplex Electric Heating Co., Cambridgeport, Mass.
Atkins, W. H., Edison Elec. Ill. Co., Boston.
Bates, Edgar W., Cohasset Electric Light Co., Cohasset, Mass.
Bates, G. M., Westinghouse Elec. & Mfg. Co., Boston.
Bliss, A. E., Malden Electric Co., Malden, Mass.
Mrs. A. E. Bliss, Malden, Mass.
Blood, W. H., Jr., Stone & Webster, Boston.
Mrs. W. H. Blood, Boston.
Brown, P. C., Brookline Gas Light Co., Allston, Mass.
Mrs. P. C. Brown, Allston, Mass.
Burleigh, C. B., General Electric Co., Boston.
Mrs. C. B. Burleigh, Boston.
Carey, G. B., Narragansett Electric Light Co., Providence, R. I.
Chase, W. W., Pawtucket Electric Co., Pawtucket, R. I.
Cole, W. H., Waltham Gas Light Co., Waltham, Mass.
Cowles, J. W., Edison Elec. Ill. Co., Boston.
Davis, C. B., General Electric Co., Boston.
Mrs. C. B. Davis, Boston.
Davis, C. S., Marlborough Electric Co., Marlborough, Mass.
Mrs. C. S. Davis, Marlborough, Mass.
Davidson, J. E., Consolidated Lighting Co., Montpelier, Vt.
Davenport, E. R., Narragansett Elec. Lt. Co., Providence, R. I.
Day, C. B., Northampton Elec. Ltg. Co., Northampton, Mass.
Mrs. C. B. Day, Northampton, Mass.
Dunn, T. L., Edison Elec. Ill. Co., Brockton, Mass.
Elden, L. L., Edison Elec. Ill. Co., Boston.
Mrs. L. L. Elden, Boston.
Gray, Jesse E., Narragansett Elec. Lt. Co., Providence, R. I.
Gallagher, F. A., Jr., Narragansett Elec. Lt. Co., Providence, R. I.
Hachfield, A. E., Narragansett Elec. Lt. Co., Providence, R. I.
Hadley, P. H., Fall Mountain Elec. Light & Power Co., Bellows Falls, Vt.
Hampson, R. H., General Electric Co., Boston.
Hodskinson, C. H., Edison Elec. Ill. Co., Boston.
Holmes, W. E., Newton & Watertown Gas Light Co., Newton, Mass.
Mrs. W. E. Holmes, Newton, Mass.
Hovey, F. H., Stone & Webster, Boston.
Hunnewell, J. A., Lowell Electric Light Corp'n, Lowell, Mass.
Ingalls, Roger P., Simplex Electric Heating Co., Cambridgeport, Mass.
Keenan, W. J., Pettingell-Andrews Co., Boston.
Kerr, Joseph, Dedham & Hyde Park Gas & Electric Co., Dedham, Mass.
Mrs. Joseph Kerr, Dedham, Mass.
Knowlton, H. S., *Electrical World,* Newton, Mass.
Lukes, J. B., Stone & Webster, Boston.
Marsh, C. D., Edison Elec. Ill. Co., Boston.
Maxwell, M. A., Massachusetts Lighting Co., Boston.
Mrs. M. A. Maxwell, Boston.
Meloon, W. G., Twin State Gas & Electric Co., Dover, N. H.
Moultrop, I. E., Edison Elec. Ill. Co., Boston.
Nelson, A. F., Edison Elec. Ill. Co., Brockton, Mass.
Paul, C. A., Bridgeport Electric Light Co., Bridgeport, Conn.
Mrs. C. A. Paul, Bridgeport, Conn.
Peckham, W. T., Naragansett Elec. Light Co., Providence, R. I.
Perkins, Oscar H., Stuart-Howland Co., Boston.
Price, F. S., Pettingell-Andrews Co., Boston.
Mrs. F. S. Price, New Bedford, Mass.
Price, C. R., New Bedford Gas & Edison Light Co., New Bedford, Mass.
Robinson, T. Russell, Grafton Electric Co., Boston.
Rollins, R. W., Hartford Electric Lighting Co., Hartford.
Ross, M. S., Hyde Park Electric Light Co., Hyde Park, Mass.
Sanderson, F. N., Abington & Rockland Light & Power Co., Abington, Mass.
Sargent, F. C., Malden Electric Co., Malden, Mass.
Mrs. F. C. Sargent, Malden, Mass.
Scherck, Leon C., Boston.
Smith, F. E., Edison Elec. Ill. Co., Boston.
Smith, H. W., Fort Wayne Electric Works, Boston.
Smith, S. F., Salem Electric Lighting Co., Salem, Mass.
Mrs. S. F. Smith, Salem, Mass.
Tonkin, W. J., The Ansonia Electrical Co., Ansonia, Conn.
Townsend, A. F., Cape Breton Electric Co., Ltd., Sydney, Cape Breton.
Tregoning, Edgar, Attleboro Steam & Electric Co., Attleboro, Mass.
Mrs. Edgar Tregoning, Attleboro, Mass.
Wade, E. C., Boston.
Wahn, C. P., Westinghouse Elec. & Mfg. Co., Boston.
Whitaker, J. S., Rockingham County Light & Power Co., Portsmouth, N. H.

Convention "Special" from Chicago.

A large and congenial party, a swift and handsomely appointed train and pleasant weather during the most charming season of the year made the journey from Chicago to Atlantic City on the "Electric Light Special," over the Pennsylvania Railroad, a delightful introduction to the duties and pleasures of convention week. Ninety-two (92) ladies and gentlemen were on the train, which was in charge of Messrs. J. J. Schayer, Western manager of transportation for the N. E. L. A., and F. O. Birney, local passenger agent in Chicago for the Pennsylvania lines. Both of these gentlemen were most attentive to the comfort of their passengers. The train was run as a second section of the "Pennsylvania Special," the 18-hour train between Chicago and New York, and it made practically the same fast time, leaving Chicago at 3:05 p. m. on May 30 and arriving in Atlantic City, 900 miles distant, at 10 a. m. May 31. It was drawn by two powerful locomotives for a portion of the distance, and consisted of 1 composite-car, 1 dining-car, 4 standard 12-section sleepers and 1 observation-compartment car. Stops were made at Fort Wayne, Ind., and Lima, Ohio, to take on passengers, and the run through five States was made so quickly that it hardly amounted to more than a night's ride. The party was one of the largest ever carried for an equal distance to an electric-light convention.

Before starting the party, grouped at the end of the train, was photographed in the Union Station, Chicago. The train had several distinguishing features. The dining-car interior was beautifully decorated with twining vines and flowers, interspersed with miniature lamps in red, furnished with the compliments of Electric Commonwealth Edison Company. Special menu cards of artistic design were provided. Every lady was presented a frangrant bouquet of sweet peas. The Central Electric Company installed small Opalux shades in the smoking room of the composite car, and in the compartment car. Electric fans were liberally provided. At breakfast on Monday the tables in the dining-car were ornamented with small American flags in honor of Decoration Day.

Following is an alphabetically arranged list of the names of those traveling on the Chicago special train:

Adams, B. C., Lincoln Gas & Electric Light Co., Lincoln, Neb.
Allen, C. E., General Electric Co., Schenectady, N. Y.
Almert, Harold, Chicago.
Armstrong, G. W., Excello Arc Lamp Co., Chicago.
Baker, Frank J., North Shore Electric Co., Chicago.
Barker, W. J., Denver Gas & Electric Co., Denver.
Beardsley, Havilah, Westinghouse Elec. & Mfg. Co., Kansas City.
Mrs. H. Beardsley, Kansas City.
Beck, H. M., Elec. Stor. Bat. Co., Chicago.
Birney, F. O., Pennsylvania R. R., Chicago.
Boyer, Frank N., General Elec. Co., Chicago.
Brooks, Richard A., Denver Gas & Elec. Co., Denver.
Bryan, F. A., Indiana & Michigan Elec. Co., South Bend, Ind.
Burling, W. R., *Electric City Magazine,* Chicago.
Busch, Joseph W., Westinghouse Electric & Mfg. Co., Chicago.

Bushnell, S. Morgan, Commonwealth Edison Co., Chicago.
Chappelle, C. C., Westinghouse Machine Co., Chicago.
Mrs. C. C. Chappelle, Chicago.
Cheney, Edwin H., Wagner Elec. Mfg. Co., Chicago.
Cobb, J. W., Washington Water Power Co., Spokane, Wash.
Colman, W. H., General Elec. Co., Chicago.
Cravath, J. R., Associate Editor *Electrical World*, Chicago.
Cushing, Frederick W., Highland Park, Ill.
Dodd, Philip S., *Electrical Review and Western Electrician*, Chicago.
Dostal, J. F., Denver Gas & Elec. Co., Denver.
Duffy, C. N., The Milwaukee Elec. Rway. & Light Co., Milwaukee.
Eaton, Walter R., Cambridge Elec. Light Co., Cambridge, Mass.
Edkins, Ernest A., Commonwealth Edison Co., Chicago.
Fellows, W. H., Leavenworth Light & Heating Co., Leavenworth, Kans.
Flannigan, R. L., Springfield Light, Heat & Power Co., Springfield, Ill.
Fox, Wm. A., Commonwealth Edison Co., Chicago.
Frantz, Howard M., H. W. Johns-Manville Co., Chicago.
Gilchrist, James M., Federal Elec. Co., Chicago.
Mrs. J. M. Gilchrist, Chicago.
Glaze, H. C., General Elec. Co., Denver.
Mrs. H. C. Glaze, Denver.
Golding, Frank H., Rockford Elec. Co., Rockford, Ill.
Hale, Irving, General Elec. Co., Denver.
Hammond, Edgar H., American Electrical Works, Chicago.
Harris, Edward O., Harris Elec. Co., Mt. Pleasant, Mich.
Hodgson, Wilbur S., Des Moines Elec. Co., Des Moines, Ia.
Holland, Henry F., Pacific Elec. Heating Co., Chicago.
Mrs. H. F. Holland, Chicago.
Junkersfeld, Peter, Commonwealth Edison Co., Chicago.
Keily, William E., Associate Editor *Electrical World*, Chicago.
Kuehmsted, A. O., Gregory Elec. Co., Chicago.
Mrs. A. O. Kuehmsted, Chicago.
Learned, John G., North Shore Elec. Co., Chicago.
Lloyd, Edward W., Commonwealth Edison Co., Chicago.
Logan, Frank G., Economy Light & Power Co., Joliet, Ill.
Mrs. Frank G. Logan, Joliet, Ill.
Lukes, George H., North Shore Elec. Co., Chicago.
Lyman, James, General Elec. Co., Chicago.
MacDonald, William B., Evansville Gas & Electric Light Co., Evansville, Ind.
McJunkin, Wm. D., McJunkin Advertising Agency, Chicago.
Mrs. Wm. D. McJunkin, Chicago.
Miss Helen McJunkin, Chicago.
Malia, James P., electrician for Armour & Co., Chicago.
Manley, John C., Commonwealth Edison Co., Chicago.
Means, E. C., Westinghouse Elec. & Mfg. Co., Denver.
Mrs. E. C. Means, Denver.
Michaelsen, Waldemar, City Electrician, Omaha.
Miley, J. J., Minneapolis General Elec. Co., Minneapolis, Minn.
Munroe, Charles A., Economy Light & Power Co., Joliet, Ill.
Mrs. Charles A. Munroe, Joliet, Ill.
Ohmer, J. P., Indiana & Michigan Elec. Co., Elkhart, Ind.
Osborn, M. C., Washington Water Power Co., Spokane, Wash.
Overshiner, E. B., *Popular Electricity*, Chicago.
Mrs. E. B. Overshiner, Chicago.
Perry, Frank L., representing *Convention Daily* and C. W. Lee Co., Chicago.
Pinckard, W. R., Westinghouse Elec. & Mfg. Co., Chicago.
Pomeroy, J. G., Adams-Bagnall Elec. Co., Chicago.
Porter, H. C., Lincoln Gas & Elec. Light Co., Lincoln, Neb.
Ryerson, W. N., Great Northern Power Co., Duluth, Minn.
Sawyer, P. B., Des Moines Elec. Co., Des Moines, Ia.
Saylor, Geo. A., H. W. Johns-Manville Co., Milwaukee.
Mrs. Geo. A. Saylor, Milwaukee.
Schayer, John J., Commonwealth Edison Co., Chicago.
Schweitzer, S. E., Omaha Elec. Light & Power Co., Omaha.
Springer, E. S., Leavenworth Light, Heat & Power Co., Leavenworth, Kans.
Stannard, Clare N., Denver Gas & Elec. Co., Denver.
Mrs. Clare N. Stannard, Denver.
Tait, Frank M., The Dayton Lighting Co., Dayton, Ohio.
Tate, H. F., National Conduit & Cable Co., Chicago.
Turner, H. W., Butte Elec. & Power Co., Butte, Mont.
Tuttle, H. S., *Electrical Review and Western Electrician*, Chicago.
Von Dachenhausen, A., Butte Elec. & Power Co., Butte, Mont.
Wallace, R. S., Peoria Gas & Elec. Co., Peoria, Ill.
Watson, H. E., Benjamin Elec. Mfg. Co., Chicago.
Young, H. W., Central Electric Co., Chicago.
Young, Henry Walter, *Popular Electricity*, Chicago.
Zimman, I. B., Omaha Elec. Light & Power Co., Omaha.

Opening of Alaska-Yukon-Pacific Exposition.

The Alaska-Yukon-Pacific Exposition was opened by President Taft at 12:30 p. m., June 1, a golden telegraph key set with Alaska nuggets, previously described, being used for the occasion. This key was connected in the White House to the transcontinental lines of the Western Union Telegraph Company, and the current relayed through to a small building just behind the stage of the amphitheatre at the Fair Grounds in Seattle, where a relay was placed to start various devices to announce the formal opening of the fair. The receiving of the message and the design and installation of the receiving apparatus was in charge of Mr. J. D. Ross, electrical engineer for the city of Seattle, who introduced several new ideas.

The amphitheatre is a natural one, sloping toward the east, and will seat thousands of people. At the bottom of the slope is a stage with a seating capacity for 1,500 people. Directly beyond this stage, in full view of the audience, are two large firs, and between these an American flag, claimed to be the largest in existence, was unfurled. This flag measures 36 ft. x 104 ft.

The instant the impulse arrived from the White House the relay on the Western Union line actuated a release and time-limit device on a large bell placed on the stage, and five strokes on this bell one second apart announced the opening of the fair. Simultaneously with the ringing of the bell another relay connected to the street lighting circuits, which were not otherwise used, and through this connected to the city lighting substation, five miles away, at Seventh Avenue and Yesler Way. At the substation another relay picked up the message and closed a 250-volt direct-current circuit, between ground and another street lighting circuit which passes the two largest whistles in the city, those of the Stetson & Post Company and the Moran shipyards, where the battleship *Nebraska* was built. Solenoids were attached to these two whistles, and through these the President announced the opening of the fair.

The time limit device which actuates the bell at the amphitheatre continued to operate, and at the last stroke of the bell actuated a trip with counterweights, which slowly unrolled the flag at an even rate of 10 ft. per second. When the flag ceased to unroll, five dynamite bombs were exploded at intervals of one second.

Another relay opened the shutter of a camera turned on the audience of the amphitheatre and a photograph taken of the audience waiting expectantly for the President's message. Fifteen seconds later a second photograph was taken, when the audience had reached the highest pitch of enthusiasm. These photographs will be presented to the President. As direct current for power purposes were not available in time at the grounds, all devices there were actuated by 60-cycle alternating current at 110 volts.

Extensions of Chicago Sanitary District Electrical Service.

The Sanitary District is doing a large amount of underground work in extending its distribution system. One of its recent contracts is for supplying electrical energy to the new hospital for consumptives, which is to form a part of the Cook County Hospital at Wood and Harrison Streets, Chicago. The District was the lowest bidder for supplying this electricity, its bid being 2 cents a kw-hour, which is an especially low rate made to county institutions. The new Sanitary District substation at Ashland Avenue and Thirty-fifth Street, Chicago, will be ready for service in a week or 10 days. An additional exciter unit will be added to the Lockport power house, consisting of a twin turbine, 350-kw generator and switchboard. Thirty miles of four-pair, lead-covered, paper-insulated underground telephone cable wire will be laid to connect the power house at Lockport with the Western Avenue station in Chicago.

American Association of Electric Motor Manufacturers.

The annual meeting of the American Association of Motor Manufacturers was held at Virginia Hot Springs on May 24, 25, 26 and 27, when there was an excellent attendance of 60 members, not including guests. During the week a number of interesting and valuable papers and reports were discussed.

On Tuesday, May 25, a paper was presented on "Cost Accounting" by Mr. Benjamin A. Franklin, of Miller & Franklin Company. In the afternoon reports were adopted from the committees on advertising, publicity and expositions, membership, central stations, and other manufacturing associations.

On Wednesday a paper was read by Mr. R. S. Feicht on "Government Specifications," and a report was read from the committee on commercial and engineering practice. In the evening a smoker was given.

Thursday was a busy day. A paper was read by Mr. James Burke on "Methods of Comparing Prices of Motors," followed by discussion. Reports were presented on a number of topics, by committees, including insurance, inspection and regulation.

The officers elected for the ensuing year are: President, S. L. Nicholson; vice-presidents, Class A, C. W. Holtzer; (B) J. C. Hobart; (C) J. W. Ham; executive committee, Class A, C. F. McGilvray; (B) R. J. Russell; (C) F. S. Hunting.

During the convention there were a golf tournament, won by Mr. Charles Robbins, of the Westinghouse Company, and a target-shooting tournament, won by Mr. R. J. Russell, of the Century Electric Company.

Annual Meeting of Oklahoma Electric Light, Railway & Gas Association.

About 50 companies were represented at the annual meeting of the Oklahoma Electric Light, Railway & Gas Association, held in Oklahoma City on May 18, 19 and 20. The program included the reading and discussion of papers of both local and general interest. Mr. J. W. Brown, chief electrician Oklahoma Gas & Electric Company, read the first paper, entitled "Concrete Poles for Permanent Construction," an abstract of which will be printed in another issue. In the discussion which followed the reading of his paper Mr. Brown described in detail the methods of handling the molds and of pouring the concrete mixture of which the poles are cast. Chats were used for the aggregate in the Oklahoma City poles, but selected gravel should give equally good results. Mr. Fred T. Benson, of the General Electric Company, presented a paper relating to the use of 4-cp tungsten lamps for sign lighting. Mr. Lawrence Martin, vice-president of the Chickasha Water Power Company, then described the water-power development in which his company is interested. A head of 20 ft. was obtained by damming the Wacheta River and building a comparatively short intake. Power is generated by two trunk turbines driving 300-kw generators. These have been operated successfully since January, and it is expected that additional units and turbines will be installed as needed until the full water capacity of 1800 hp is utilized. This total amount of power may be had on an average of 18 hours per day. A gas-engine of 275 hp capacity has lately been installed to be used in emergencies. The dam cost about $30,000, and the water-power plant is operated by two men only, each being paid $1.75 per day.

Mr. C. E. Lahman, manager of the Vinita Electric Light, Ice & Power Company, spoke enthusiastically of the water-power possibilities of the eastern part of Oklahoma. The streams there run through rocky beds between the Ozark Mountains, so that good foundations for dams are available, and backwater could easily be taken care of. The rivers are spring-fed and have a more constant flow than those in the western part of the State. The country until lately had been inhabited by Indians and others who had not been progressive, and therefore the opportunities for development were great.

At the opening of the session on the second day Mr. F. H. Tidnam, manager of the Oklahoma Gas & Electric Company, presented his address as president of the association.

President Tidnam directed attention to the great progress in electrical development in the State of Oklahoma during the past year. There has been much activity and promotion in the building of electrical interurban railways, and the water-powers of the State are beginning to receive close attention. He recommended that a competent person should be employed by the association to report to members on the subject of new laws, to give technical information and render other assistance where required. Also, the appointment of a committee to assist small plants in the preparation of reports required by the State, and a business manager for the association, under salary. He advocated changing the name of the association to the Oklahoma Public Utilities Association.

Mr. Galen Crow, of Guthrie, secretary of the association, next spoke of association affairs and outlined a plan for enlarging the scope of the organization by making eligible to membership all public utility companies within the State. After discussion, the association voted to change its name to the Oklahoma Public Utilities Association.

Mr. Charles Hunter, chief engineer of the Oklahoma Gas & Electric Company, described the method for burning oil and gas used in the station of that company. A paper on "White Way Street Lighting" was then presented by Mr. F. W. Caldwell, general manager Shawnee (Okla.) Gas & Electric Company, an abstract of which will appear later. In the discussion which followed the reading of the paper the author stated that his experience had shown it to be a good plan when introducing block lighting first to fully develop one block and then use this as an inducement when soliciting service for other parts of a city. In Shawnee two men had installed 12 brackets and lamps (one side of a block) in one day. Lamps were placed 25 ft. apart to get an even distribution and opal globes had been found most satisfactory because the opalescence showed a "light within a light." The globes were 8 in. in diameter, enclosing 60-watt tungsten lamps. Mr. Caldwell said that within three days after the lamps in the first block had been operated he had contracted for similar lighting covering practically the whole business district of Shawnee. He had found that the "white way" tended to keep people about town awake later and to hold them in the business district longer during evenings, so that the down-town load was increased about 10 per cent. The charge to the merchants along the street was 5 cents per night for each lamp, the company maintaining the lamps.

Mr. F. E. Bowman, manager of the Ada Electric & Gas Company presented a paper on the best methods for obtaining increased load. In discussing this paper, Mr. Galen Crow said that the Guthrie Electric Company had found it profitable to do the city pumping; for three years current had been furnished to operate two 75-hp motors driving pumps which operated against heads of 340 ft. and 280 ft. respectively. The charge to the city was based on the quantity of water pumped, and varied according to a sliding scale from 5 cents to 2½ cents per 1000 gal. All water over 500,000 gal. per day was pumped at the 2½-cent rate. The water was measured by Worthington meters at the pump discharge. The pressure for distribution is ordinarily obtained from a standpipe, but valves were provided so that the pumps might discharge direct to the mains for fire service. Between 13,000,000 gal. and 18,000,000 gal. were pumped each month. The company lately had made an exchange of service contract with the city whereby the company would pump the water used in the city's new filtration plant in return for a sufficient amount of filtered water for use in the company's boilers. Mr. Crow volunteered to give other plants data on pumping which he had collected.

A paper was presented by Mr. Frank Whitten, Oklahoma Gas & Electric Company, on "How to Collect Public Utility Accounts." Mr. R. F. Riseling, auditor of the same company, then read a paper on "Proper Accounting for a Small Company."

Mr. E. C. Reynolds, Sopulpa Light & Power Company, described the gas engine plant operating the generators of that company. Two 150-hp engines were operated at a cost of about $70 per month for natural gas, one engine being run 9 hours per day and the other 24 hours. The very rich gas used furnished a horse-power-hour on 14 cu. ft. or 15 cu. ft. Orders were being placed for larger engines to drive both railway and lighting generators. Mr. F. S. Meyer, Oklahoma Gas & Electric Company, described the meter practice of that company, and Mr. S. F. Dibble, of the General Electric Company, presented a paper on "Small Motors." Mr. W. A. Haller, general manager Oklahoma Railway Company, then presented a paper on "High-Tension Combined Railway and Lighting Service," an abstract of which will appear later. In the discussion Mr. Haller said that the total losses between generators and cars in New Orleans were less than 15 per cent. Mr. Fred Bedford, of Lawton, next described a model ordinance suitable for an electric lighting property in Oklahoma.

At the final session the following papers were presented: "Effect of Tungsten Lamps on the Income and Business of a Plant in a City of 20,000 Inhabitants," by Mr. H. E. Foster, Ardmore; "Tracks, Lines and Cars," by Mr. W. A. Haller, general manager Oklahoma Railway Company; "Tungsten Lamps and Gasolene Competition in a City of 2000 Inhabitants," by Mr. L. B. Griffin, Atoka; "How to Get Customers in a Small City Well Supplied with Oil and Natural Gas," by Mr. S. J. Smallwood, Bartlesville; "Enlarging the Scope of the Association," by Mr. Galen Crow.

The following officers were elected to serve during the ensuing year: President, Mr. E. C. Reynolds, Sopulpa; secretary, Mr. Galen Crow, Guthrie; treasurer, Mr. H. G. Stetman, Chandler.

Convention of Ohio Society of Mechanical, Electrical and Steam Engineers.

The semi-annual convention of the Ohio Society of Mechanical, Electrical and Steam Engineers was held at Canton, Ohio, May 21 and 22. The members of the society met at the Courtland Hotel, Friday afternoon, May 21, and were taken by special car on an inspection trip through the plants of the Canton-Hughes Pump Company and the Canton Boiler & Engineering Company, where they were courteously received and inspected the various processes employed in the construction of pumps and boilers. The remainder of the afternoon was passed in a tour through the principal districts of this city.

At 8 p. m. President F. W. Ballard called to order the first session and, after a brief address of welcome by Mr. C. A. Dougherty, president of the Board of Trade, adequately responded to by the president, Mr. G. H. Gibson, of New York, presented a paper entitled "Hot Salt Water for Steam Boilers," which presented the advantages of the open feed-water heater for the utilization of the heat and exhaust steam. It was contended that this type furnishes a rational method for converting cold, hard water into hot, soft water for steam boilers, and that among its advantages over other systems are simplicity in construction; less room occupied; less cost for building, fittings and installation; greater ease of operation, and absolute prevention of corrosion and the formation of hard scales. The discussion which followed the reading of the paper was participated in by Mr. W. C. McCracken, superintendent of buildings of the Ohio State University; Mr. T. M. Sterling, chief engineer of the Diamond Portland Cement Company, Middlebranch, Ohio, and Mr. William Long, superintendent of machinery of the Toledo Railways & Light Company.

Following this, Prof. H. B. Dates, head of the Electrical Engineering Department of Case School of Applied Science, of Cleveland, read a brief paper on "The Interpole Motor," in which he presented in a simple manner the principles of its design. Part in the discussion which followed was taken by Mr. R. D. Crawford, chief electrician of the Babcock & Wilcox Company, of Barberton, Ohio, and Mr. C. J. Miller, chief engineer and electrician of the American Roll & Foundry Company, of Canton, and others

The last paper of the evening was one on "Heat Insulation" by Mr. L. O. Hooge, of Cincinnati, Ohio, which was presented by Mr. A. E. Brown, of Cleveland, in the absence of the author. The paper stated the principles of heat conduction, convection and radiation, and gave the result of tests of different kinds of heat-insulating material. Calculations are also given showing the amount of saving that may be effected through preventing the loss of heat by the use of a proper insulation. Mr. C. H. Richards, of Lockland, Ohio, and Mr. Brown, both of whom are specialists in heat insulation, discussed the paper.

The second session was called to order at 9:30 a. m., May 22, immediately following a meeting of the Council. President Ballard presided over the brief business session held, in the course of which he reported on the progress of the society, then called on the secretary to give a brief report of the business transacted by the Council, chief of which was the purging of the membership roll, consideration of propositions relative to printing the publications of the society, and the reading of some interesting correspondence, indicating that the society is gaining in standing, and that its publications are in demand. It was reported that the Council did not consider the society as yet in position to conduct an employment department, but, of course, it recognizes its obligations to assist members in whatever manner this can be done through the office of the secretary, and by announcements at the meetings.

The secretary then read in abstract his paper on "The Ethics of Society Membership," emphasizing and illustrating how the society can be put to a considerable expense and the officers called upon to do considerable extra work, merely because members are frequently too careless in the matter of their obligations to the society, financial and otherwise. With respect to service on committees, he emphasized that inasmuch as such opportunities are not presenting themselves very often to any one member, they should be taken advantage of, by rendering service promptly and by endeavoring to make a record by its achievement, as covered by Emerson's words: "The reward of a thing well done is to have done it." The secretary then read in abstract a paper on "Continuous Melting" by Mr. R. H. Probert, past-president of the society. In this paper an account was given of the continuous melting of iron in a foundry in which two cupolas are operated alternately. Information was also included concerning molds and casting operation.

Mr. B. F. Fisher, of Londonville, Ohio, then presented a paper on "Lubrication of Steam Cylinders by Grease," which advocated the use of grease over oils for the lubrication of cylinders. It is stated that a pint or a pound of grease will do the work of 5 lb. of cylinder oil. The author recommended a particular form of cup for grease lubrication, which was described and illustrated. The paper was discussed by Mr. R. J. Brown, mechanical engineer of the Ohio Brass Company, Mansfield.

In the afternoon the members of the society were taken on an inspection trip through the power house of the Northern Ohio Traction & Light Company, and the city water-works, finishing their trip by a visit to the McKinley monument.

The third and last session was called to order by President Ballard at 8 p. m. He announced the appointment to various committees, including the membership committee, committee on publications, and research committee. The latter will control the character of the papers to be presented before the society, and includes in its membership Prof. W. T. Magruder, head of the mechanical engineering department of Ohio State University, and Prof. H. B. Dates, of the Case School of Applied Science. Thirty-three active and one associate members were also elected at this meeting. Invitations were presented from the Columbus Board of Trade, the Commercial Club, of Springfield, by President Ballard, representing Cleveland, and by Mr. Ira Cole, representing Lima, all asking the society to hold its next meeting in the respective cities; when the matter was put to vote Lima, Ohio, was decided upon, the dates of the meeting there to be Nov. 19-20, 1909. Mr. A. L. Eustice, of Pittsburgh, then presented a paper entitled "Recent Development in Glower Lamps and Their Application to Modern Illumination Practice." The paper gave descriptions of the latest types of Westinghouse Nernst lamps, together with illumination curves and comparisons showing the superior efficiency of this type of lamp over other electrical illuminants. In the discussion, Mr. J. A. Hoover, of Cleveland, gave data as to the cost of lighting by Nernst lamps, and forms of lighting contracts. A paper by Mr. Julius Roemer, of Cleveland, Ohio, on "Some Practical Points on Power-Plant Piping" was then presented by Mr. James L. Butler, chief engineer of the American Steel Foundries Company, of Alliance, Ohio, who added a description of systems he has installed in his plants. The society then adjourned after various expressions of satisfaction at the success of the meetings—for which due credit was given the local committee on arrangements.

The Toll-Line Telephone Decision.

In Ohio comparative quiet has succeeded the decision of the United States District Court opening up the long-distance telephone field to all companies which care to compete upon an equal basis. Neither side has made a move to indicate that warfare will result and neither has made any announcement of its intentions in this direction. The independents are watching the situation closely and will take action, if necessary, to protect their interests against invasion, but at the same time people feel that the decision has placed all companies in a position where they will take care of their own business and be careful about treading upon each other's toes. In part a statement issued by the Bell people, following the decision, is as follows:

"When, last November, Judge Tayler, of the United States

court in Ohio, issued a temporary restraining order, ex parte, upon the filing of the bill of the United States Telephone Company, the independent telephone promoters throughout the country had much to say about the effect of such action, publishing many statements under the heading of 'A decision against the Bell by the United States court.'

"Now that Judge Tayler has decided the case after an argument by the counsel for both sides, and has found adversely to the claims of the United States Company on all points, it is perhaps natural that, in the excitement of the moment and before the decision has been carefully digested, statements should be made which are not borne out by the facts.

"The attitude of the Central Union Telephone Company toward the independents who have invested their money has been wholly misunderstood. The Central Union Company desires to prevent duplication of investments throughout its territory, believing that such duplication must result ultimately in loss to the public as well as to the investor, and to that end has sought to interest the independent companies at points where there was no duplication in a method of operation by such independents which would harmonize all interests and bring about the best results to the public.

"Having this in mind, it has made connecting contracts with hundreds of independent exchanges, thereby broadening the scope of such exchanges and guaranteeing to the people the widest possible telephone service at the minimum cost consistent with proper business principle. It has not endeavored to get such independents to sever their connections with other toll lines at any point. It has not sought any underhanded or undue advantage over its competitors, but has been working to the end it believed to be the logical outcome—the unification of the telephone business of the country with safety to the real investor, to its own securities and to those of the independent.

"It does not believe in stock jobbing or stock watering, which the public is ultimately called upon to pay.

"We have no fight with the man who has honestly invested his money for the purpose of rendering to the public a service which was needed in his community, and we desire to assist him in every way possible, but we are unalterably opposed to the methods of those who, for personal gain and without regard to the future needs of the business and the people, seek to build up competing telephone systems, or who seek to force the public to pay on watered securities.

"We feel that this decision by Judge Tayler is the most important that has been rendered in many years and are grateful to him for the careful consideration and able opinion resulting therefrom. He has cleared the air."

Modern Electric Vehicles.

At the meeting of the New York Electrical Society, held in the Engineering Societies Building, New York, May 27, Mr. Day Baker read a paper on "The Practical Application of the Modern Electric Vehicle." Mr. Baker remarked, by way of introduction, that the electric vehicle was not a competitor of the gasoline machine; each had its own field. He described, and illustrated by lantern slides, many commercial electric vehicles and trucks used in the principal cities. A large jewelry house in New York operates 22 electric vehicles and a prominent dry-goods firm reports that in operating costs it saves 28 per cent by using electric wagons as compared with former horse service.

The company he represented has spent much money in experiments with a view to reducing the cost of electric vehicles to the lowest figures. This result it has attained by the reduction of friction, by using ball or roller bearings in the motors, countershafts and wheels, and an efficient silent chain or roller chain-drive between the motor and the wheels. Less energy is thus required, and a lighter and smaller battery may be used. The decrease in battery weight admits of the use of a lighter framework, reducing the dead weight, and further reducing the energy consumption, the battery weight and the friction loss. Another important improvement is the use of a single motor for driving the vehicles, in place of two or four sometimes used in the past.

An electric vehicle, he said, cannot be used profitably where it is not needed. Where the work that is done is less than half the ability of the machine, proper value cannot be derived from the investment. There are also localities where operating conditions prevent a satisfactory return for investment. In England and Wales there are now in operation some 11,000 commercial motor vehicles, and in the United States between 7000 and 8000. In London alone there are 1080 motor buses.

At the conclusion of the lecture a communication was read from Mr. Alexander Churchward in which he discussed the "wattage" or energy consumption of the electric vehicle. In studying the performance of the storage-battery vehicle the "wattage," i. e., watt-hours or energy consumption per ton-mile, he said, was the one most important subject when accomplishing certain predetermined results. The energy consumption, however, is influenced by a number of factors, the principal ones being tires, motors, correct gear ratios, alignment of axles and driving mechanism, diameter of wheels, etc., and these in turn are more or less influenced by the design of the vehicle.

He then considered the segregated losses consecutively and explained how they influence the ultimate or total energy demands of a vehicle. A few years ago, he said, a commercial vehicle consuming 120 watt-hours per ton-mile was considered satisfactory; to-day the energy consumption has been reduced to 70 watt-hours per ton-mile, and in some cases as low as 60. Unless a commercial vehicle is capable of running at its full speed loaded, on hard, level asphalt at an input considerably under 100 watt-hours per ton-mile, it could hardly be said to be successful as far as design and cost of operation are concerned.

New Orleans Electricians' Licensing Law Declared Unconstitutional.

The law for licensing electricians, passed by the Louisiana Legislature last year, has been declared in violation of the Fourteenth Amendment to the Constitution of the United States and therefore invalidated. The decision was rendered by Judge Frank D. Chretion of the Criminal District Court of the city of New Orleans, in the case of George Gantz, charged by a member of the State Board of Electrical Examiners and Supervisors with doing electrical wiring without the prescribed license. The defendant was neither a member of the wiremen's union, nor of the New Orleans Electrical Contractors' Association. His attorney, Mr. George G. Smart, filed a demurrer alleging class legislation on account of the section exempting the Railways, Light & Power Company, and quoting the Fourteenth Amendment. He was sustained on that ground alone, the court declaring it unnecessary to go further.

An appeal has been taken by the Supreme Court of the State by the prosecuting officer, the District Attorney. A decision may be had in six months. Meanwhile the decision will act practically to suspend present operations in prosecuting unlicensed electricians in doing work in the city of New Orleans, although a reversal by the Supreme Court would render them liable.

The New Orleans Electrical Contractors' Association is in cordial relations with the Board of Electrical Examiners and Supervisors, who will continue to issue licenses to any who may comply with its conditions. The association has reduced its initiation fee from $100 to nothing for eligible master electricians, and the board has employed a special attorney in addition to its regular counsel to confer and advise on the possibility of sustaining the law before the Supreme Court of the State, before carrying on litigation. Another law that will hold, in the event of abandonment of the present statute, may be presented to the Legislature next year.

The public regarded the licensing measure as a means to pursue poor workmen by wealthier competitors for business, and workmen were shrewd and quick in creating sympathy by declaring they were deprived of a chance to earn a living. Business that could be handled by contractors at a profit was taken by men for wages and material costs, with perhaps a very small margin. The reasons for fighting the law are principally a fear of losing the $25 exacted for each examination, a feeling that the amount is too much, and a belief that the insurance inspection of the electrical hazard is sufficient for all purposes. The bureau, on the other hand, would favor a reduction from the 230 odd applications by different parties to a reasonable number of qualified and responsible men.

Judge Chretion, in his opinion, says that the "greatest complaint is levied against the section of the act, which, after providing that all electrical workers must be under the supervision of 'master electricians,' exempts from its operation lighting companies, electric railway companies and the department of police and public buildings of the city of New Orleans, in so far as the maintenance and installation of their equipment pole line service and meters are concerned.

"It becomes evident that when conditions are imposed by a law upon a class of people permitting them to carry on their avocation, that the conditions have to apply equally to all those belonging to that class, and that the law has no right to exempt any members of that class from the operation of that law, without being in direct conflict with the provisions of the Fourteenth Amendment of the Constitution of the United States. In this case there is clearly a discrimination made in favor of certain people and corporations falling under the class legislated for, and in my opinion this makes the act unconstitutional, as it does not afford to all of the same class the same guarantee and equal protection which is required by the Constitution."

Continuing, the court says: "The Fourteenth Amendment undoubtedly intended not only that there should be no arbitrary deprivation of life or property but that equal protection and security should be given under all in like circumstances in the enjoyment of their personal and civil rights. That no impediment should be interposed to the pursuits of anyone except as applied to the same pursuits of others under like circumstances; that no greater burdens should be laid upon one than are laid upon others in the same calling and condition, and that in the administration of criminal justice no different or higher punishment should be imposed upon one than as is prescribed to all for like offenses."

New York Public Service Commission News.

Within the next few days it is expected that several definite plans will be submitted to the Public Service Commission of the First District of New York for the construction of subways in the greater city. The Interborough Rapid Transit Company is preparing plans for a $100,000,000 proposition to connect the three boroughs of the Bronx, Manhattan and Brooklyn. This plan, it is said, will be amended to meet the expressed views of the commission. The Bradley-Gaffney-Steers Company is also preparing to submit a bid to build a subway from the Harlem River to the Bridge loop. Several other propositions, including the water-front plan of the Amsterdam Corporation and a moving sidewalk scheme are also said to be in course of preparation.

Governor Hughes has signed the Travis-Robinson bill which provides for the construction of rapid transit routes in New York City by private capital. This bill also contains a provision under which the property owners who have benefited by the construction of a subway can be assessed for a portion of its costs. It is the adoption of this law that has stimulated subway propositions.

Among the committees which were named under a recent act of the New York Legislature providing for investigations was the following, which will look into Public Service Commission matters: Senators, Meade of Rochester, Davenport of Clinton, McCarren of Brooklyn; Assemblymen, Merritt of St. Lawrence, Yale of Putnam, Ward of New York, Walters of Onondaga, Caughlan of New York.

The commission has extended until Oct. 15 the time limit for the Metropolitan Street Railway Company to equip its cars with wheel guards, under the order recently made.

The Board of Estimate, of New York City, has returned to the Public Service Commission the franchise recently granted to the Hudson & Manhattan Railroad Company to build a subway under Sixth Avenue from Thirty-third Street to the Grand Central Station. This was done because the Interborough Rapid Transit Company objected to the plans under Forty-second Street. Mr. McAdoo, president of the Hudson Tunnel Company, has protested against the hold-up and has promised to construct his line exclusively under the southern half of Forty-second Street.

At the hearing before Commissioner Milo R. Maltbie, May 25, in the general investigation of electric light and power companies, J. W. Lieb, Jr., vice-president of the New York Edison Company, read a list of the private concerns which are using the streets for conduits without, as the Edison company claims, any legal authority. These installations, as a rule, are connections between adjacent buildings owned by the same interests. Mr. Lieb also reviewed the various steps by which the New York Edison Company had acquired the smaller companies that preceded it, with their franchises. The old contract between the Brush Electric Illuminating Company and the Edison company was fully explained. Carleton Macy, for the Queens Borough Gas & Electric Company, testified as to the lighting contract for the village of Rockaway Beach. This includes Edgemere, Arverne and all the territory east of these on Rockaway Beach. The franchises of the old companies, which were subsequently obtained by the Queens Borough company, were fully explained.

CURRENT NEWS AND NOTES.

COMPULSORY EXTENSION OF TELEPHONE LINES.—The Connecticut Legislature has passed a measure by a vote almost unanimous providing for the compulsory extension of telephone lines.

NEW YORK FIRE-ALARM SYSTEM.—The City of New York has made a preliminary appropriation of $100,000 for a new fire-alarm system. Such a system has been under advisement for the past six years, and has been the subject of report by Mr. Kempster B. Miller.

PORTUGESE RADIUM DEPOSIT.—A large deposit of uranite phosphate has been discovered near Guarda, Portugal. The mineral is said to contain more than 50 per cent of oxide of uranium, and should be at least three times superior to pitch blende for radium-producing purposes.

TELEPHONE COMPETITION IN NEW YORK CITY.—The Public Service Telephone Company has filed an application with the Empire City Subway Company for space in the subways for its telephone wires. It claims the right to place its wires in the subways under the franchise of the Longacre Light & Power Company, which it has taken over.

RIGHT OF MUNICIPAL PLANT TO SELL SUPPLIES.—A suit has been filed in an Indiana circuit court by J. S. Kelley, an electrician and supply agent of Frankfort, Ind., to enjoin the city officials of that place from selling incandescent electric lamps to the public. The complaint alleges that the ordinance authorizing the city light committee in charge of the municipal plant to sell lamps in sufficient quantities to supply the public is contrary to law and to the charter under which the city operates. The question of competition in matters of this kind on the part of a municipality is a new one.

AUTOMOBILES.—There are now about 160,000 automobiles in the United States, of which 69,000 are registered in New York State. On Jan. 1 there were 41,727 automobiles in Germany, of which 2,252 were for the transportation of freight.

JACK BINNS BEFORE THE WIRELESS INSTITUTE.—Mr. Jack Binns presented a paper entitled "The Wireless Telegraph in Marine Service" before the Wireless Institute at its regular monthly meeting, June 2, in the Engineering Societies Building, New York.

COLLEGE ELECTRIC RAILWAY.—Clemson College, the State institution of South Carolina, proposes to build a short electric line from the college to Calhoun, for the purpose of making a close and direct connection with the nearest railroad main line. The new road will be used for both passenger and freight service.

INTERNATIONAL PATENTS.—At the meeting in London last week of the International Congress of Applied Chemistry, a motion made by an American delegate providing for the appointment of a committee to draft proposals for joint international patent and trade-mark legislation, was carried unanimously and the committee appointed.

CONVENTION OF CANADIAN ELECTRICAL ASSOCIATION.—The next annual convention of the Canadian Electrical Association will be held at the Chateau Frontenac, Quebec, Canada, June 16, 17 and 18. In addition to the reading of papers there will be a number of topical discussions. Committees on statistics, theft of current, meter inspection and grounding of transformer secondaries will present reports. Mr. T. S. Young, Toronto, Ont., is secretary of the association.

GAS HEAT AND COAL HEAT—A Chicago coal company is using large space in the local newspapers to set forth the greater economy of coal over gas for heating purposes. A report by Mr. A. Bement, the fuel expert, is included, which gives comparisons in the form of squares, showing the heat obtainable for $1 from gas and several grades of coal. The square representing gas at 90 cents per 1000 cu. ft. has but a small fraction of the area of squares representing the several grades of coal.

CONVENTION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—The Association of Railway Telegraph Superintendents will hold its next annual convention at the Hotel Pontchartrain, Detroit, Mich., June 23, 24 and 25. Some practical papers on railroad telegraph operation will be presented, and the use of the telephone in railroading will also receive considerable attention. Mr. William Maver, Jr., is down for a paper on "Wireless Telegraphy." Mr. P. W. Drew, Chicago, is secretary of the association.

ELECTRIC HEADLIGHTS.—An interesting situation has arisen in the State of North Carolina over the recent enactment of the Legislature requiring that all locomotives be equipped with electric headlights of at least 1500 cp. The Atlantic Coast Line has asked for total exemption, and the Seaboard for exemption for day trains and branch lines, while the engineers are making a strenuous effort to have the law carried out to the letter. The corporation commission has had several hearings over the matter, but nothing definite has been decided upon yet.

RAILROADS TO STUDY ELECTRIFICATION.—As an indication of the interest the railroads are taking in the subject of electrification, it may be noted that at a recent meeting of the American Railway Association a committee of seven members was appointed to make a study of the subject and to prepare a comprehensive report for submission at a meeting of the association in the fall. Mr. F. A. Delano, president of the association, will select the committee, and the resolution provides that the members may be re-elected at the November meeting, for the ensuing year.

BELFAST KELVIN STATUE.—An unfortunate complication has arisen concerning the location of the memorial statue to Lord Kelvin in his native city of Belfast. It had been decided to erect the statue in the grounds of the Queen's College, but it was subsequently pointed out that such use of the grounds would be legally a breach of trust under the terms of tenure of the property. In the meantime, some of the subscribers to the memorial have served formal notice on the Lord Mayor restraining him from expending any of the money subscribed until the questions regarding the site have been satisfactorily determined.

NATIONAL ELECTRICAL CONTRACTORS' CONVENTION.—The National Electrical Contractors' Association will hold its ninth annual convention at Toledo, Ohio, July 21, 22 and 23, with headquarters in the Boody House. There will be open sessions at 10 a. m., July 21 and 22, at which representatives of other branches of the electrical industry will give practical talks. On July 23 there will be a boat excursion to Sugar Island for an all-day outing with field sports and a baseball game. The banquet will be held on the evening of July 22. All electrical contractors, whether members of the association or not, are invited to attend all the meetings. Mr. W. H. Morton, Utica, N. Y., is secretary of the association.

EDISON ILLUMINATING ASSOCIATION.—The preliminary announcement of the Association of Edison Illuminating Companies has just been issued setting the date for the annual convention Aug. 31 to Sept. 2, inclusive. This is about two weeks earlier than usual. The place of convention is Briarcliff Lodge, Briarcliff Manor, about 35 miles from New York, overlooking the Hudson River from one of the highest promontories, with splendid mountain scenery in every direction. A preliminary meeting is to be held on Monday evening, Aug. 30, and it is suggested that members arrive not later than that time. The nearest railroad station is Scarborough on the New York Central, about 30 miles from the Grand Central Depot. Mr. W. W. Freeman, of Brooklyn, N. Y., is president of the association, and Mr. D. L. Huntington, of Spokane, secretary.

HUDSON-FULTON CELEBRATION.—New York City at the time of the Hudson-Fulton celebration, next October, will be lighted up as never before in history. Chairman William Berri and the members of the committee on illumination visited last week all the historic points in the city which will be especially featured at the coming anniversary and concluded the trip by awarding to the New York Edison Company the contract for lighting the various streets and places around which interest will center. Following this, Mr. Arthur Williams, of the Edison company, announced that he would undertake to festoon Fifth Avenue with lights, beginning at Washington Square and extending to Central Park. In all there will be used 150,000 separate lights burning in Fifth Avenue during the eight days of the celebration. In addition all the borough halls will be especially illuminated, the Washington Arch, in New York, and the arch at Prospect Park, in Brooklyn. Grant's Tomb will not be illuminated out of considerations of good taste, but instead giant searchlights will be turned on the building which will bring it out in relief. Mr. Williams made the suggestion that the people of New York should co-operate with his company and light their residences and places of business in order to heighten the effect.

Producer Gas-Engine Station at Hoopeston, Ill.

THE Hoopeston Gas & Electric Company, of Hoopeston, Ill., has operated a 280-hp gas engine on producer gas since June, 1908. The engine and the two producers which supply it are of the Munzel type, built by the Minneapolis Steel & Machinery Company. The engine, which is of the twin type, consisting of two single-acting engines connected to the same shaft, runs at a speed of 176 r.p.m. The cylinders are 21¾-in. diameter by 32-in. stroke. A 17-ton flywheel also acts as a belt pulley from which is belted a 200-kw, 60-cycle, 2300-volt alternator. This unit is shown in Figs. 1 and 2.

The two producers which supply this engine are shown in Fig. 3. These producers have a nominal capacity of 150 hp each. Anthracite coal of buckwheat size is used in them. A 5-hp motor drives a chain hoist for elevating coal from a hopper just outside the producer-room to a bin over the producers.

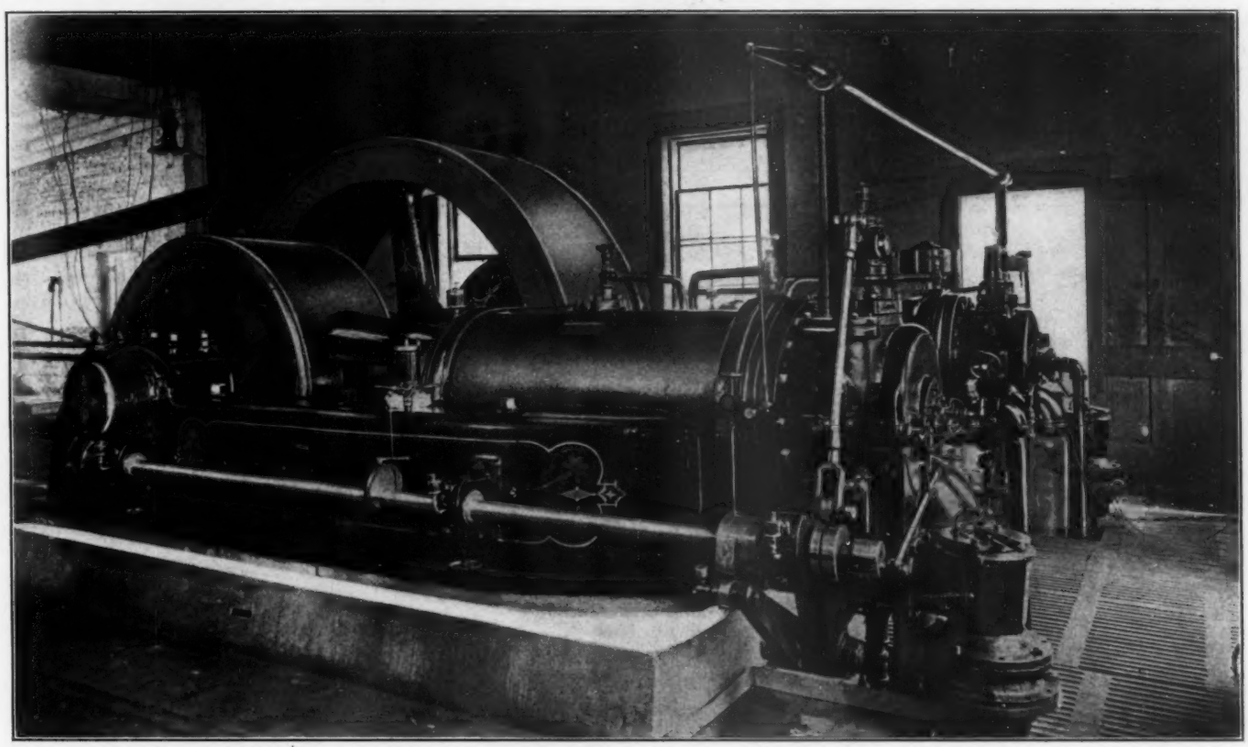


FIG. 1.—280-HP GAS ENGINE AT HOOPESTON, ILL.

From this bin it is let down as needed through a pipe into the producer hoppers.

A cross-section of the producer and wet scrubber is shown in Fig. 4. The producer is at the left and the scrubber at the right. The producer hoppers have the usual air-lock arrangement whereby the hopper is closed tightly by a valve held shut by a weight before the coal is dumped from the hopper into the producer. The coal is fed down to the fire in the producer by a short magazine. The coal settles down in the magazine as fast as the coal in the lower part is consumed. The producer has rocking grates for shaking down the ashes, and poke holes are also provided around the top so that a poker can be inserted to poke around the walls of the producer next to the fire. Very thick, heavy fire-brick lining is used. The air with which the producer is supplied is drawn in under the grates from a preheater located between the producer and scrubber. This preheater raises the air to a high temperature before it reaches the fire in the producer. This heating is accomplished by passing the air along passages heated by the hot gas coming from the producer.

In order to mix a certain amount of steam or vapor with the air sucked into the producer, a vapor pan is provided at the top of the producer which is partly filled with water kept boiling by the heat in the producer below. The steam and vapor given off from this vapor pan are mixed with the air drawn into the producer at a kind of mixing valve, seen just above the preheater, thus introducing some hydrogen into the gas. From the producer the gas passes through the wet scrubber, at the right, which is simply a long cylinder through which water is continually sprayed. The bottom has a water seal so as to close the scrubber from the outside air. This scrubber takes out most of the impurities, ashes, etc., which are drawn through from the producer. From the wet scrubber the gas passes through a dry scrubber, which is simply a kind of strainer, and is inserted as an additional precaution not absolutely necessary. From the dry scrubber it is drawn to the engine through a receiving tank, which is inserted in the pipe line for the purpose of equalizing or reducing fluctuations in suction caused by the strokes of the engine.

This is a suction-type producer; that is, when the engine is in operation the draft through the producer is caused by the suction of the engine on the producer. The oxygen of the air uniting with the carbon of the fuel forms carbon monoxide or producer gas. When the producer gas reaches the engine it is burned to carbon dioxide, CO_2. In this process of burning fuel, approximately one-third of the heat units which would be liberated by the total combustion of the coal are liberated and wasted in the process of burning the coal to producer gas. The other two-thirds are liberated at the time the producer gas is burned in the gas-engine cylinders. The heat units liberated in the process of producer gas-making are largely dissipated by radiation from the producer and piping and by transfer to the water in the wet scrubber. Although the process of utilizing producer gas in a gas engine involves throwing away about one-third of the heat units caused by combustion in the first process of producing the gas, and also involves the waste of about half the remaining heat units in the exhaust of the engine and in the cooling water used in the engine jackets, the total cycle of operations gives much more useful energy per pound of coal than the process of burning it under a boiler for the operation of a steam engine.

The engine at Hoopeston consumes about 3 lb. of anthracite coal per kw-hour for a monthly run. Many 24-hour records are

better than this, as shown later. This is based on actual recording watt-hour meter readings at the switchboard. Fig. 6 shows a curve of kw-output for each hour of the day, as taken from the readings of the recording watt-hour meter every hour. From this it is seen that the engine is not operating under conditions at all favorable to economy, because even at peak load it is not nearly loaded. The maximum load is 130 kw, and the rated capacity of the engine and generator is 200 kw. The efficiency of any gas engine operated by a governor which throttles the mixture is very low on light load as compared to the efficiency on full load.

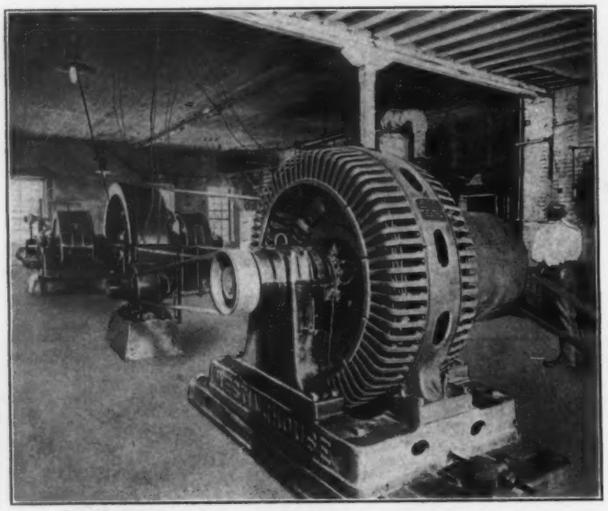


FIG. 2.—200-KW GENERATOR AND GAS ENGINE.

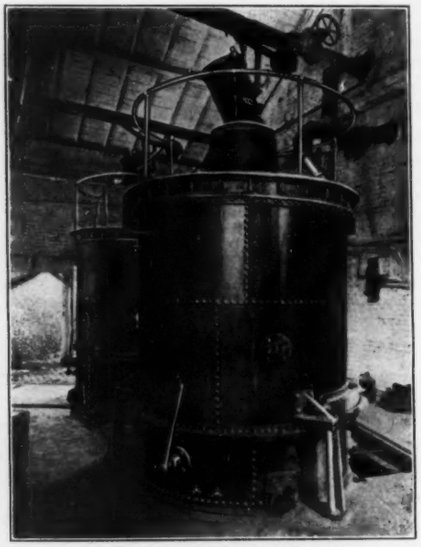


FIG. 3.—MUNZEL GAS PRODUCER.

To obviate this condition of running a large engine 24 hours per day, much of the time very lightly loaded, a second engine of the same type and make is being installed. This second engine is to be a single-cylinder engine of 100-hp rated capacity, 18¾-in. x 28-in. stroke. The speed will be 190 r.p.m., and it will carry a 10-ton flywheel, 8 ft. 6 in. in diameter. This engine will be able to carry the load most of the day, and will give the station a reserve gas-engine unit. Heretofore the reserve has been in the shape of a steam-engine unit and boiler, which were part of the former equipment of the station before the gas engine was introduced.

The steam plant, before the gas-engine plant was put in, took from 10 tons to 12 tons of soft coal for a 24-hour run at a prevailing price of $2 per ton. The price of anthracite coal is in the neighborhood of $4.50 per ton. For the 24 hours' output for which the curve is shown in Fig. 6, which is the output for Jan. 23, 1909, the consumption of anthracite coal by the producers was 2730 lb. and the output 1290 kw-hours, equivalent to 2.1 lb. per kw-hour. On March 31, 1909, the consumption was 2496 lb. for an output of 1060 kw-hours, or 2.5 lb. per kw-hour. For April 1, 1909, the output was 930 kw-hours, the coal consumption 2028 lb., making the consumption 2.18 lb. per kw-hour. On Sundays and days of very light load the consumption is, of course, higher per kw-hour. Even with a consumption of 3 lb. per kw-hour, which has been the prevailing figure for considerable periods of time, the cost of fuel per kw-hour, with hard coal at $4.50 a ton, would be only 0.675 cent, which is far lower than could be obtained with a non-condensing steam plant operating under similar light-load conditions with $2 soft coal. This figure will probably be lowered at least 30 per cent when the smaller engine is started.

As considerable water is required for the engine jackets and gas scrubber, the company operates its own deep-well pump with a 5-hp motor. This pump has an automatic starter controlled by a float in an elevated tank, so that the pump is started whenever the water supply in the tank falls below a certain level.

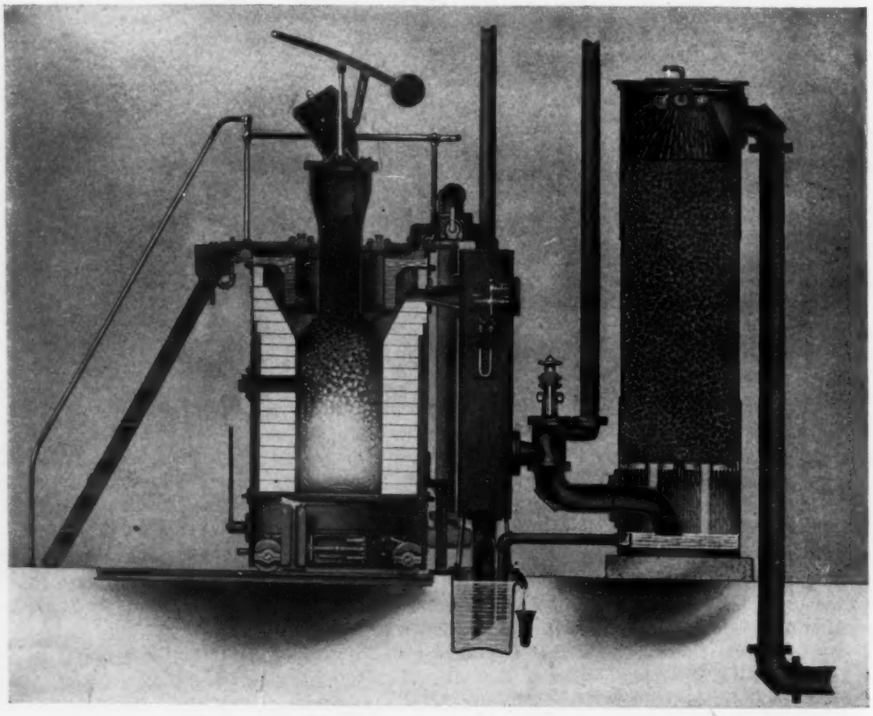


FIG. 4.—CROSS-SECTION OF PRODUCER GAS APPARATUS.

As is the case with all gas engines, the space occupied by this unit is large for the output obtained. The 280-hp engine

occupies a floor space of 17 ft. x 18 ft. 10 in. As to reliability, which is now one of the chief points of interest in connection with any producer-gas engine plant, the history of this plant seems to have been the same as that of a number of others. During the first few months of operation of such a plant it is an excellent thing to have a steam unit to fall back upon, as in this case, because of the time required to educate men in the proper operation of the producer. The producer is a piece of apparatus not generally understood, and while it is likely that in time a class of engineers will become educated to producer operation, no such class exists now from which to draw. Whenever a new plant is started it must depend on men supplied by the manufacturers, and such other men as the central station can pick up and train. The manufacturers themselves have difficulty in picking up good operators. The troubles experienced in this plant have been mainly an occasional slowing down of engine due to variation in the quality of gas. For long periods these troubles have not showed themselves, and, on the whole, the operation has been reliable and satisfactory and such as to justify the management in the present enlargement of the gas-engine plant. One of the troubles recently experienced has been that of free ignition of the gas before the proper time in the stroke. The trouble has apparently been obviated by greater care in poking the fires so as not to carry hot cinders which ignite the gas before the ignition spark has a chance to operate.

The soil at Hoopeston is of such a character as to give some rather startling results with engine foundations. The underlying soil is blue clay of about the consistency of dough. The foundation of the 280-hp gas engine which was built upon it allows considerable vibration of the engine itself and also causes vibration in buildings several hundred feet away. This vibration is not violent or objectionable, but is noticeable to a person looking for it. For the foundation of the new engine piles will be driven down to bedrock. This, of course, is nothing

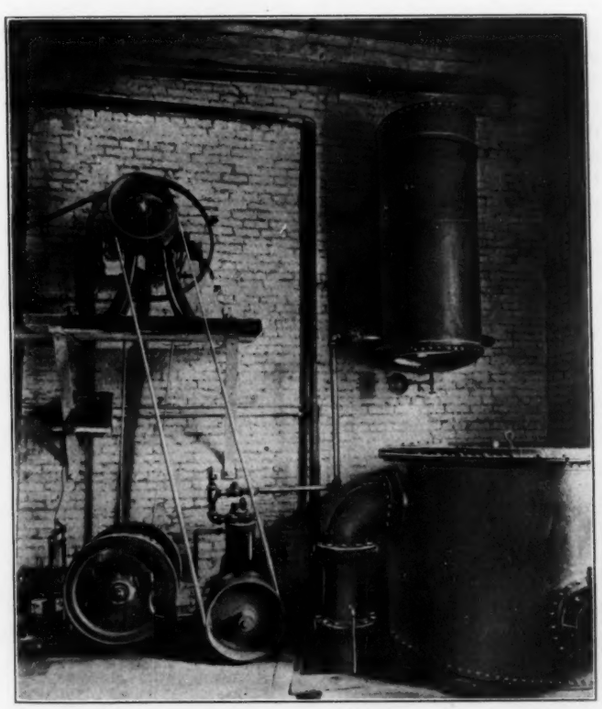


FIG. 5.—DRY SCRUBBER, COMPRESSOR AND AIR TANK.

against the apparatus, but shows what unexpected conditions are sometimes met.

Fig. 5 shows the small gasoline engine which drives an air compressor to fill the air-storage tank from which the gas engine is started. This air-storage tank is shown at the right above the wet scrubber. This small gasoline engine also drives a fan-blower with which fire is started in the producer. In this producer the fire is blown by air pressure from the fan-blower introduced in the ash pit. While this fan-blower is at work a purge-pipe, extending through the roof, is open, which acts as a chimney, out of which the air and products of combustion

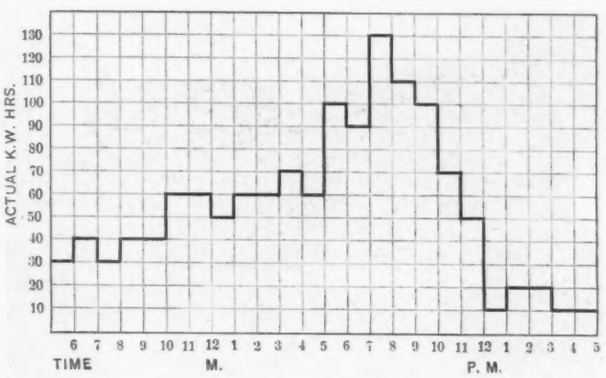


FIG. 6.—KW-HOUR OUTPUT BY HOURS, JAN. 23, 1909.

from the producer pass. When the fire in the producer has reached such a condition that producer gas is given out steadily through the purge-pipe, as indicated by the lighting of the small test flame, the purge-pipe is closed and the gas is blown through the scrubbers and receivers to the engine so as to fill the whole piping system. When these pipes are filled, the air blast is shut off and the engine started. The suction of the engine then draws air into the producers, which is changed into gas as fast as the engine requires it.

Central Power Plant at the U. S. Navy Yard, Charleston, S. C.

By A. P. Ball.

THAT it pays in power-plant work to put a considerable amount of money into the production of clean and pleasant surroundings has long been maintained by European engineers, and attention has often been directed to the fact that certain Continental power plants, equipped with machinery which in this country would be regarded as antiquated, or at least distinctly inefficient, show surprisingly good economy of operation, even when compared with American plants of the most modern design. Investigation of steam power plants in Germany and Holland, where this anomaly is

FIG. 1.—PILINGS FOR FOUNDATION SUPPORTS.

particularly pronounced, reveals the curious circumstance that scrupulous cleanliness obtains in and about the plants where the most interesting results have been obtained.

It cannot, of course, be deduced from the above coincidence that cleanliness and neatness in the engine-room are the dominant factor in the attainment of economy, but it seems to be a safe

inference that, where sufficient time and attention are devoted to the outward appearances of the plant, a correspondingly greater amount of care is given to the apparatus itself and to the development of expense-saving details. It must also be recognized that clean and orderly surroundings will have a

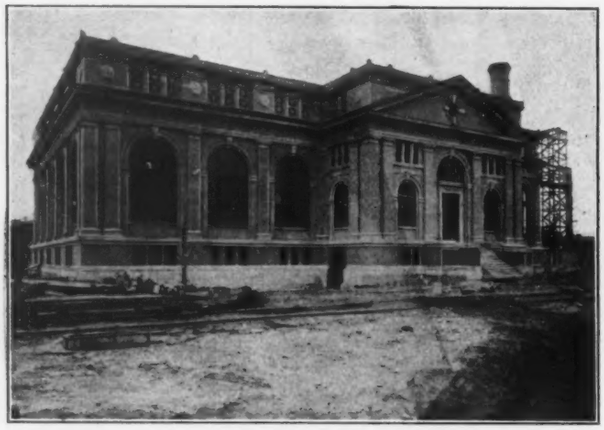


FIG. 2.—ARTISTIC POWER-HOUSE CONSTRUCTION.

practical and well-defined, though possibly intangible, influence on those employed about a steam plant, which will tend toward its betterment in every way. It is well recognized that dirt and neglect usually accompany inefficiency and waste. Would it not also seem that cleanliness is conducive of economy?

If the above conclusions are correct, it will be interesting to watch the results to be attained in the central power plant just completed for the United States Government at the Navy Yard at Charleston, S. C., for this plant is not only of attractive architectural design, with a tasteful scheme of interior decoration, enhancing the pleasing impression given by its neatness and ample proportions, but also embodies approved practice conducive to the highest economy of operation.

It is the policy of the Navy Department to replace gradually by efficient central generating stations the small and relatively inefficient power plants which are now scattered about every Navy Yard. The Charleston Yard is the first one where this plan has been carried out. This is primarily a torpedo-boat station, and the U. S. S. *Atlanta*, parent ship of the torpedo

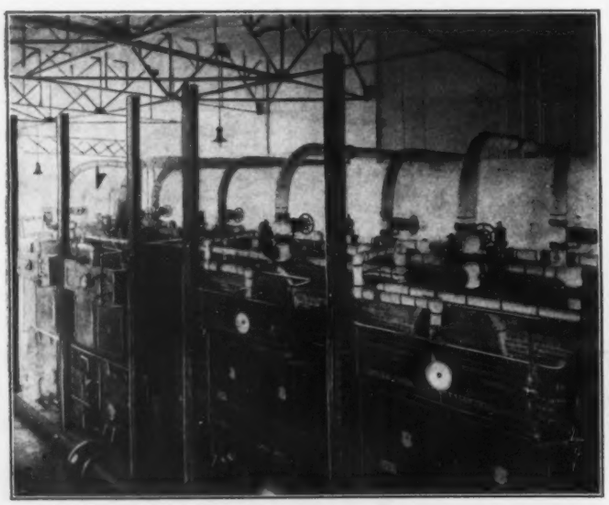


FIG. 3.—ARRANGEMENT OF BOILER PIPING.

flotilla, is permanently stationed there. The work of repairing and building torpedo boats and destroyers requires extensive boiler, foundry and machine shops, which cover a considerable area. The machine tools employed are all driven by individual motors.

In addition to the numerous torpedo-boat moorings along the Cooper River, a large granite and concrete dry dock has recently been completed, over 600 ft. in length and capable of docking the largest ships in the navy.

The pumping of the dock is done by means of four 36-in.

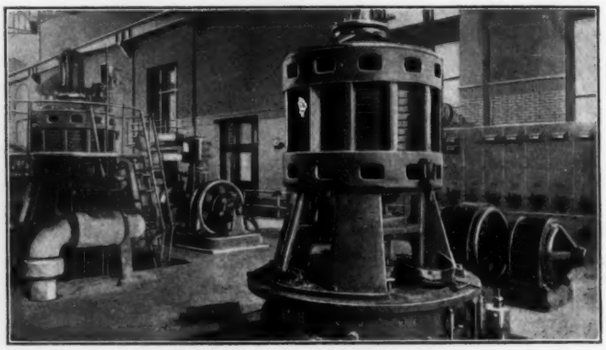


FIG. 4.—INTERIOR OF GENERATING STATION.

centrifugal pumps driven by three-phase induction motors of the vertical-shaft type. Two 12-in. pumps, similarly operated, serve for draining the dock sump. The input required by the pump motors is approximately 1000 kw.

The dock is also equipped with seven electrically driven capstans. Three are located on either side of the dock, and the seventh, a somewhat larger one, is placed at its head. Each of these capstans is directly connected to a variable-speed three-phase induction motor, and is arranged for driving in either direction.

The yard also possesses quite an extensive lighting system. Not only does the plant supply the illumination of the shops, offices and warehouses, but it also provides for the lighting of the officers' quarters, which are segregated at the northern extremity of the reservation, some distance from the rest of the yard buildings.

The new central power plant was designed to replace the several small stations now in use, and to supply energy throughout the yard for all the above requirements. The mechanical equipment for this plant was furnished and installed by Muralt & Company, of New York City, and has been in operation for some time.

The most favorable site for the station, from considerations of energy distribution, was unfortunately a low, marshy stretch of ground, quite characteristic of most of the land along the Cooper River. The final selection of this site rendered the question of suitable foundations rather serious. It was found necessary to drive 16-in. wooden piles very closely together practically all over the site, and reinforce them with large amounts of concrete, in order to carry the weight of the building and equipment. The nature of the ground is clearly shown in

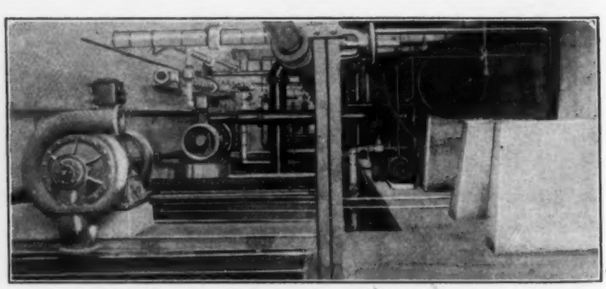


FIG. 5.—STEAM AUXILIARIES.

Fig. 1, which also gives some idea of the piling required and difficulties that were encountered in securing a satisfactory foundation.

The station building itself is by far the most imposing edifice on the reservation, being of a semi-classic style of architecture

with spacious dimensions and plain yet pleasing lines. It is of steel construction, with hard-pressed straw-colored brick walls, trimmings and foundation facings of white sandstone. Its general appearance is shown in Fig. 2.

The interior is divided by a tile partition from end to end, into two spacious rooms used as boiler and engine rooms, respectively. Each is of ample size and is unusually well lighted by numerous large windows. The engine-room, with its walls faced with white tile up to a height of about 10 ft. above the floor and hard-pressed brick from there on up to the lofty ceiling, is very attractive.

The boiler equipment consists of four 350-hp Heine water-tube boilers set in two batteries. They are capable, however, of furnishing an output 50 per cent in excess of their nominal rating for a period of 12 hours continuously. Each boiler has 3500 sq. ft. of actual heating surface and 80 sq. ft. of effective grate surface. These boilers are equipped with Murphy automatic stokers capable of burning sufficient bituminous coal to maintain the boilers in operation continuously at the above overload.

Each boiler is fitted with a Foster superheater sufficiently large to add 100 deg. Fahr. to the temperature of the steam at 150 lb. gage pressure. Provision has been made in the piping system for operating the plant on either superheated or saturated steam, and suitably arranged dampers have been installed for cutting out the superheaters when saturated steam alone is being taken from the boilers.

Fig. 3 gives a general view of the boiler batteries, showing in particular the saturated and superheated connections from each boiler to the engine-room steam headers. The flue is shown passing over the tops of the boilers. During the recent acceptance tests conducted by a board of Government engineers, these boilers showed an efficiency very close to 80 per cent.

A fuel economizer of Sturtevant make, consisting of 28 10-tube sections, is installed in the flue next to the boilers, on a supporting platform of I-beam construction, with a by-pass whereby the flue gases may be diverted entirely or partially around the economizer. Arrangements are made for coal pockets, which will be added at a later date.

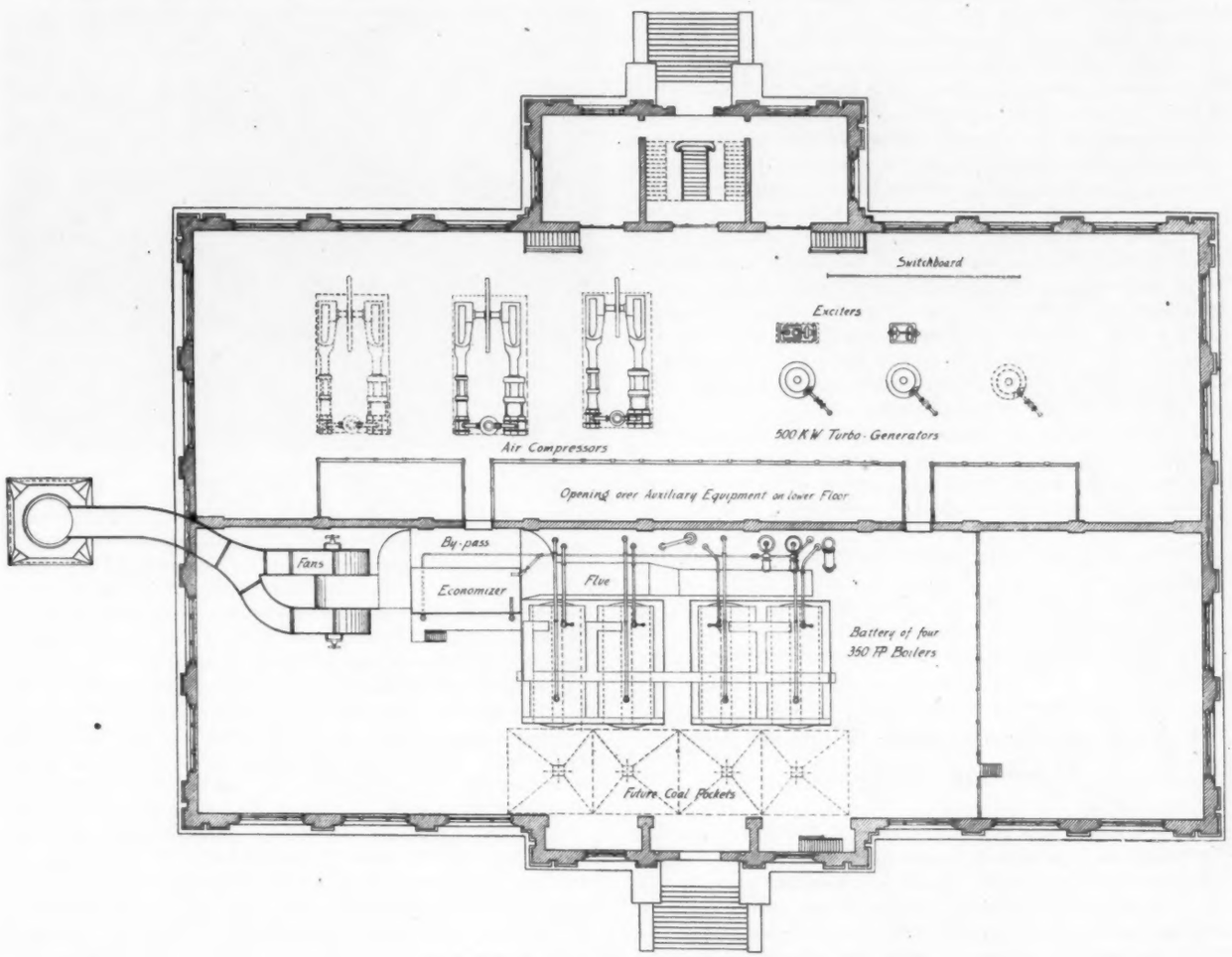


FIG. 6.—PLAN VIEW OF GENERATING STATION.

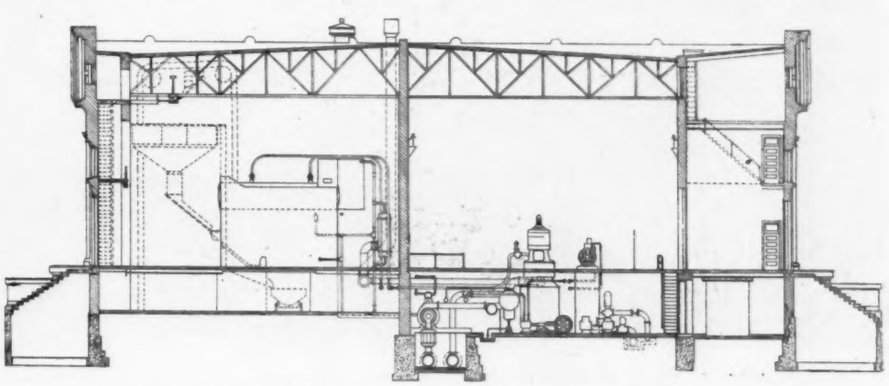


FIG. 7.—SECTIONAL ELEVATION OF GENERATING STATION.

The engine-room equipment consists primarily of two 500-kw Curtis turbo-generator sets, which are clearly shown in Fig. 4. This illustration gives an idea of the general interior appearance of the engine-room and scheme of decoration before mentioned.

The turbines are so designed as to operate at 150 lb. initial steam pressure, 100 deg. Fahr. super-temperature and 28 in. of vacuum. Their steam consumption at full load is well within 18.4 lb. per kw-hour. The generators are wound for 2300 volts, 60 cycles, three-phase currents. Each unit is provided with a 35-kw compound-wound exciter set, wound for 125 volts. One exciter is driven by a simple, non-condensing vertical steam engine, the other by a 50-hp, three-phase motor. The switchboard consists of 27 panels of blue Vermont marble.

The engine-room also contains two Laidlaw-Dunn-Gordon steam-driven, Corliss-type, cross-compound air compressors for supplying air for pneumatic riveting machines, drills, etc.

The condensers, pumps and all auxiliaries of the engine-room equipment are located on a floor directly below the engine-room, a view of which is shown in Fig. 5. A large opening along the entire length of the engine-room floor makes all of this auxiliary equipment readily available and at the same time sends a flood of light into the basement.

The piping lay-out is designed to make the most direct connections between the headers and the various units, with bends of large radius. The present piping system has been designed to provide for future extensions, all mains being properly proportioned to take care of the installation of additional units. A maximum of reliability has been the object in view in the arrangement of the entire system.

Figs. 6 and 7 show plan and elevation, respectively, of the generating station and are self-explanatory.

The plant was built by the Bureau of Yards and Docks, Admiral R. C. Hollyday, chief.

A Farm Hydro-Electric Plant Without Operating Attendant.

By P. J. O'Gara.

THAT a farm electric power plant, which will operate without the presence of an operating attendant, is not only possible, but practical has been demonstrated in a small power plant owned by Mr. Ellis Franklin, of Colfax, Cal. About two years ago when the writer first visited the Franklin estate his attention was attracted by a small stream with a normal flow of a very few miners' inches of water, which winds its way through the farm, and in two places makes a plunge of nearly 100 ft. At the writer's suggestion Mr. Franklin consulted the different libraries in San Francisco and Sacramento to see if he could find some information on how to build an electric power plant that would run for, say, a week at a time, without any attention and which might be controlled from the residence; that is, started and stopped, as well as governed. After seeking in vain for information, he appealed to some engineers who told him that such a thing would not be practical. He was able to get all kinds of information on large commercial plants, but, as far as a farm plant was concerned, no practical information was at hand.

FIG. 3.—VIEW OF TRANSMISSION LINE OVER HILL.

The writer was then asked for help, and he decided to work the problem out on his own ideas. How this was done and the results of this piece of engineering are here given:

The flow of water during the summer months is restricted to a few miners' inches and it was found necessary to provide a reservoir which would store up a considerable supply of water at slight expense. An old miners' ditch, which had been used by the early placer gold miners, was enlarged and deepened so that its storage capacity is about 100,000 cu. ft. The ditch was provided with head gates and spillways, and the water of the little stream was turned into it. From the lower end of the ditch, which is provided with a pressure box, admitting water to the intake, a 6-in., No. 14 riveted-steel slip-joint pipe 445 ft. in length is carried to the foot of the falls, where the power house is situated. The intake, which is 12 in. in diameter, is provided with a wire screen of 0.5-in. mesh. The pressure box, into which the intake extends, is covered over and is also provided with a rack which keeps out all débris. When it is desired the intake can be closed, thereby shutting the water from the pipe line.

FIG. 1.—THE FALLS. FIG. 2—OLD MINER'S DITCH CONVERTED INTO A RESERVOIR. FIG. 4.—PIPE LINE AND POWER HOUSE IN DISTANCE.

The power house is situated in a canyon at the foot of the falls, but high enough so as to be out of flood water during the rainy season. It is a well-built structure, 18 ft. x 8 ft., with a 7-ft. wall plate, and strong enough to support machinery much heavier than the present installation. The water-wheel is a

FIG. 5.—WASTE GATES AND HEAD GATE OF RESERVOIR.

2-ft. Pelton of special design and was built by the Pelton Water Wheel Company in its San Francisco factory. It is furnished with ring-oiling bearings, and has run for weeks without any attention. The effective head under which it works is 75 ft., the static head being 80 ft. One end of the shaft carries a 24-in. pulley with a 6-in. face and extra heavy rim, so that with the heavy water-wheel, the couple act as a flywheel in maintaining absolutely constant speed, which is a requirement in the operation of dynamos for incandescent lighting. The other end of the shaft carries the governor pulley. Three nozzles, 1 in., 1¼ in. and 1½ in. in diameter, respectively, are provided and are interchanged according to requirements. When the water supply is short the smallest nozzle is used. The wheel, by careful test, shows a very high efficiency. With the 1-in. nozzle 2.74 hp is obtained, and with the 1½-in. nozzle exactly 6 hp is obtained. The water is supplied to the wheel through a 3½-in. Lunkenheimer stem valve which is operated by a 5-ft. lever, full valve being obtained by swinging the lever through 80 deg. of arc. The lever may be operated either in the power house or from the residence about a quarter of a mile distant.

The electrical machinery in the power house consists of a Western Electric compound-wound, 240-volt generator, with a rating of 4½ kw. It is driven at a constant speed of 1200 r.p.m. by a 4-in., four-ply rubber belt from the water-wheel pulley. Current at an initial pressure of 240 volts is carried to the distributing board in the residence about a fourth of a mile distant over a No. 8 hard-drawn copper transmission line strung on 20-ft. poles with 4-ft. cross-arms, the poles being spaced about 100 ft. apart. The voltage drop is such that the voltmeter on the switchboard at the residence indicates 220 volts, as 220-volt lamps and motors are operated from it. The residence and Mr. Franklin's den are furnished with about 50 lamps, while about 25 more are distributed about the farm buildings. The motor circuit connects with a 3-hp, 220-volt Western Electric motor, which is placed in the basement, and besides operating a centrifugal pump, drives through line-shafting the washer, wringer, churn, cream separator, grindstone and a circular saw for sawing wood up into stove size. The motor has its starting box at the switchboard, so that the pump or other machinery may be started and stopped without going near it. Besides, the line-shafting is provided with tight and loose pulleys which makes it possible to start or stop any piece of machinery without stopping the motor.

The pump above mentioned lifts water from an almost inexhaustible well to a reservoir dug in the hill-side and connected to the pump by a 2-in. pipe 250 ft. long. The reservoir has a capacity of about 6000 gal. and is placed 40 ft. above the level of the pump, furnishing the kitchen, bathroom and laundry with water at a good pressure. In the front yard there is a hose connection with a hydrant which furnishes water to the lawn and may also be used in case of fire.

In the kitchen electrical cooking and heating devices are liberally employed, and the use of an electric iron in the laundry does away with the necessity of building a fire in the stove on ironing day. Small electric stoves are also used in the living-room and bedrooms, since there is always an excess of energy above that necessary for lighting.

The most important and interesting fact regarding this plant is that it is operated from the residence, which is a quarter of a mile away from the power house. It is not necessary for anyone to go to the power house to turn the power on or off—that is, to start or stop the water-wheel. To the right of the switchboard is a crank attached to a shaft passing through the wall to the outside. This shaft carries two winding drums about 2 in. in diameter and securely keyed to it. Around each drum is wound in an opposite direction a flexible wire cable. The cables pass from the drums upward to pulleys fastened to the side of the house, then through a single block-tackle and the ends returned to a staple in the wall. The pulley-blocks are attached to two galvanized-iron wires strung over pulleys on the poles just beneath the copper transmission wires; these wires pass through bushings into the power house, the ends

FIG. 6.—VIEW OF EXTERIOR OF POWER HOUSE.

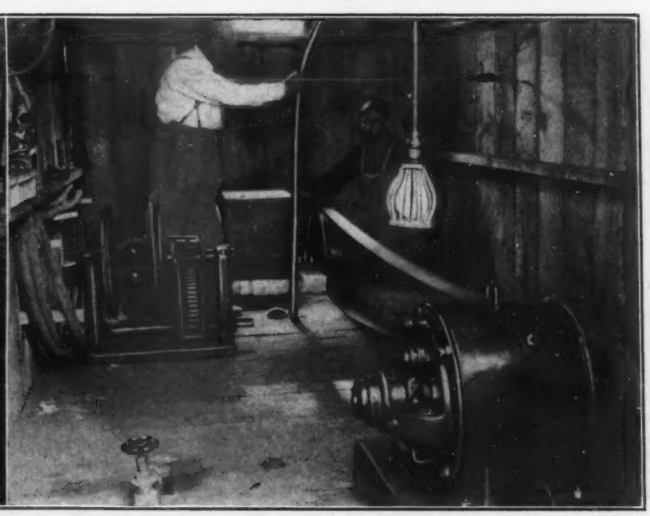


FIG. 7.—VIEW OF INTERIOR OF POWER HOUSE.

being connected to a flexible-wire cable passing through two pulleys, one on each side wall and directly in line with the gate-valve lever before mentioned. The upper end of the lever, which is about 5 ft. long, passes through an iron ring which is connected by two single pulley-blocks to flexible cables. When the crank at the residence is turned to the right, or the direction marked "on," the gate-valve lever is drawn to the right and the valve opened, admitting water to the wheel. Turning the crank in the opposite direction closes the valve. Owing to the small diameter of the winding drums and the added purchase of the pulley-blocks and crank handle, the valve is so easily operated that a child can turn the power on or off. As the switchboard and voltmeter are directly in front of the one operating the crank, the amount of power to be turned on can be closely regulated. An electric buzzer on the switchboard tells when the gate valve is tightly closed.

Mention was made of the governor. This is a small machine of the differential-gear type. The constant-speed wheel of this governor is driven by a small Pelton water-wheel, and the variable-speed wheel is belted direct to the water-wheel shaft. It operates a deflecting hood placed in front of the nozzle. The governor, however, is seldom used, since it consumes power and at the same time is not needed for constant loads, such as lighting and operating the motor for pumping purposes. When the motor is operating the washer, wringer or other easy-running machinery the variation in speed when the load is thrown on or off does not count for anything. The only time when the governor is necessary is when the motor is operating a circular saw for cutting wood into stove lengths.

As all farm equipments should be, this little electric plant is as nearly proof against careless handling as was possible to make it. Further than this it requires practically no attention and the power house need not be visited more than once a week, although it may be carrying its full load nearly all the time.

The average night load is about 5 hp, which is sufficient for all the lamps. During the day the energy is used variously for pumping, washing, etc., so that the amount of electrical energy used on the farm, if valued at the rate of 10 cents per kw-hour, would be worth more than $700 per year. When one considers the fact that the plant did not cost more than $1,500, which includes costly fixtures, water-works system, etc., it is evident that it is paying a handsome profit on the investment, the cost for maintenance being practically nothing.

Alternating-Current Industrial Power Plants.

By Warren H. Miller,
Electrical Engineer, Standard Oil Company.

Almost all large industrial establishments are the result of slow growth from the time that some one man of inventive genius and forceful personality began making something necessary to the people and made it honestly enough to retain the confidence of the buying public. The industrial engineer, whether as an employee of the works or as a consulting adviser, has frequently to deal with the modernization of such works, since, sooner or later, the ancient engines, waterwheels and other such wasteful prime movers that have served the growing company faithfully for so many years must be displaced by a modern station distributing the energy electrically. Compared to the public service corporation power houses these plants are never very large. One rated at 2000 kw will run a very large establishment, and even one rated at 100 kw will take care of quite a large concern, principally because the rating need never be much more than 40 per cent of the total motor horse-power, which itself is not large for groups of machine tools. Almost the first question that arises in modernizing the power equipment is over the choice of alternating or direct current, and it is the purpose of this article to show what can be done with the former, beginning with the smallest possible plant.

About the first thing to do is to get in touch with the foremen of the various departments and thresh out approximately what loads will come on and for how long, and once this information is really accurate, a rough load chart can be made up from which the wisest selection of the power units can be made. In further selecting engine sizes to fit these units, it is of prime importance to remember that the average industrial plant power factor seldom exceeds 75 per cent, and that it is therefore essential to consider an engine horse-power as equal to a kilowatt or kilowatt-ampere. This point is not only often ignored in practice and a kilowatt taken as 1.3 engine horse-power, with consequent poor steam economy, but the power factor and efficiency of an alternating-current plant get confused in the engineer's mind, whereas the efficiency is usually about 90 per cent, more or less. In every case the motor must be large enough to take the maximum load, whereas, nearly all the time, the load actually on is less than 50 per cent maximum, since this or that tool is idle while work is being set up in it or light cuts are being taken. The low power factor of an induction-motor load is not especially detrimental and causes no practical loss except when the generator is too small for the engine. It requires a large component of wattless current in the wires of the generator, though it is not felt by the engine. Both the field and armature circuits of the generator will thus become heated long before the engine is fully loaded. On account of this condition, for industrial work, it is poor practice to employ a generator having a kw-rating any less than the hp-rating of the engine.

Even in small sizes an alternating-current plant need be only a little more complicated than an equivalent direct-current installation. In spite of the far greater superiority of the induction motor as a shop prime mover, engineers are reluctant to adopt a small alternating-current installation on the score of complexity at the power house. The facts are just the reverse Paralleling alternators is quite simple, and with good engines, when once in parallel, they divide a fluctuating load better than compound-wound direct-current machines, and there is no upkeep of brushes and commutators. All such devices as synchroscopes, power-factor meters, frequency indicators, three ammeters for each generator, etc., which are often saddled onto the most diminutive alternating-current installations, are best left to the large power plants. They simply complicate a small board without adding one jot to its practical usefulness.

In selecting prime movers for the alternators one should flee all belt-driven arrangements and make the installation direct-connected throughout, both generator and exciter. The smallest direct-driven unit made is rated at 50 kw, and from that up there is a wide range of sizes available. The exciter is coupled to the stub end of the engine shaft and is virtually a large-framed, direct-current, slow-speed generator of about one-thirtieth the rating of the alternator. In selecting the engine to drive machines, get the best. The high-class engine builders not only put in plenty of metal where it is most needed, but invariably supply an efficient continuous-oiling system reaching every part of the engine as part of the equipment. In smaller plants this enables the electrician to attend to all sorts of outside work, merely visiting the engine occasionally to see that nothing is heating up. The two-bearing engine has many good reasons for preferment, the principal being that two bearings not only divide the load equally, but are easier to line and keep lined up as they wear. In the three-bearing unit the load is lopsided, giving uneven wear on the bearings, all three of which must be in line. The latter is preferable, however, in direct-current work owing to the practical objections to turning up the commutator on the long shaft of the two-bearing engine with its accompanying flywheel. This must be shipped to the electrical manufacturer, pressed on the shaft and then swung in a lathe, flywheel and all, and a few thousandths of an inch turned off to get the commutator absolutely true. With the rings of the alternator no such accuracy is required and the revolving field structure is pressed on the shaft in a few hours' time by the erecting crew. Of course, in a three-bearing unit the armature shaft is made separable and can be swung in an ordinary lathe at such times as it becomes necessary to turn up the commutator. In

the event of a burned-out armature section the engine does not have to be pulled apart in either case. With the two-bearing engine the field structure is simply moved to one side, uncovering the armature, and in the three-bearing the armature itself can be taken out of the engine.

In any event, the purchaser should look carefully to the oiling system the engine builder puts on. If it needs a pump, the whole responsibility for the running of the plant is on the check valves of the pump, and a fine piece of grit can, and will, get under the check valves and shut down the plant with melted-out crank-brass babbitt. If a splash system of oiling is employed, sure-to-work arrangements should be provided to get oil to every working part and get it back again. While on the subject of oils it might be pointed out that many a first-class engine has been thrown into the scrap heap for lack of proper oil. Just because the engine may be small, say, 100 hp, the engineer goes up to the machine shop and gets a can of ordinary machine oil to put into the crankcase. It doesn't worry him in the least that the floor of the engine room is soon covered with half the oil he put in, nor that a knock is developing in the crankpin, which was as closely lined as steel and brass will permit. He simply takes out another liner and then wonders why the pin is knocking again inside of 48 hours. The sole trouble is that the oil has not enough body and the pin throws it off like water, and no amount of splashing will force it in between the steel and the brass. If one of those gravity systems with little sight-feed needle valves at every bearing is installed, trouble looms large ahead, for the only remedy for too light an oil is a heavier one, or else the admixture of about one-fourth cylinder oil to give it body. In either case the heavy oil will not feed through the needle valves with any certainty. The usual remedy is to cover the engine with lubricator cups, just as is done after a few trials of the oil-pump scheme.

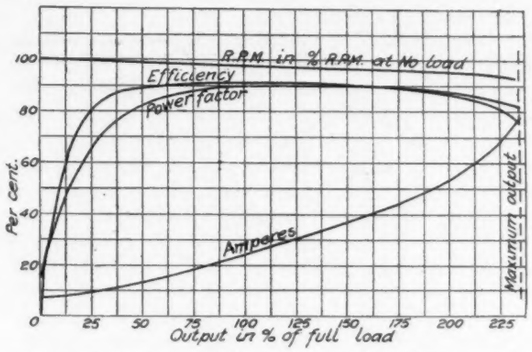


FIG. 1.—CHARACTERISTIC CURVES OF INDUCTION MOTOR.

As regards governing the engines for parallel running, all the high-speed engines are very easy to manage, provided only that the governor is of the flywheel type and reasonably sensitive. The writer has paralleled four alternators driven by engines with as many different makes of Rites governors, the engines ranging from 300 hp down to 65 hp, and had no trouble in making each engine carry its share of the load. This is in three-phase work, which is the only system considered for industrial plants having a mixed load of motors, arcs and incandescent lamps. In selecting the frequency either 60 or 25 may be used, preferably the former, without getting into serious difficulties, except in the arc lamps. There has not as yet been developed a really good 25-cycle arc lamp to the writer's knowledge, though the flaming arcs do well on 25 cycles out-of-doors or in large power houses. The tantalum cluster, however, enables this question to be handled without much difficulty. A frequency of 25 cycles is superior in that standard motor speeds of 750 r.p.m. to 500 r.p.m. are much handier for shop drives than the 1200 r.p.m. of the 60-cycle motors, and if a 720-r.p.m. motor is obtained the cost will be about equal to that of the 25-cycle motor. However, unless there is some special reason to the contrary, 60-cycle equipment gives the cheapest and most flexible arrangement and will parallel quite as well with high-speed steam engines as will 25-cycle machines.

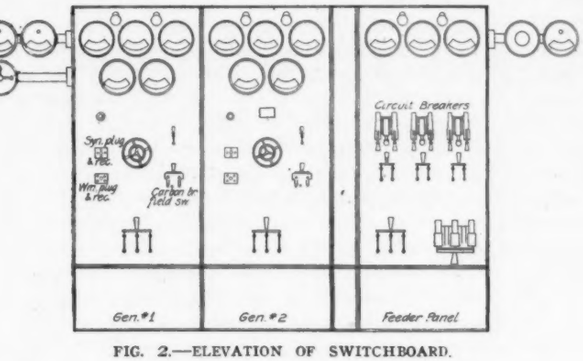


FIG. 2.—ELEVATION OF SWITCHBOARD.

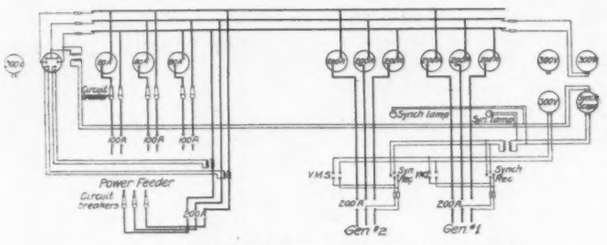


FIG. 3.—DIAGRAM OF SWITCHBOARD CONNECTIONS.

Having selected engines and generators, the next care will be the switchboard. In this the purchaser should aim above all for simplicity. The switchboard manufacturers have standard panels which cover requirements quite completely, but even these are often too full of interesting, but unnecessary, instruments for a small plant. A good indicating three-phase wattmeter is the most valuable instrument that can be placed on the board. It tells just what the machine is doing, whereas the readings of the ammeter, or ammeters if there are three of them, are interesting, but not impressive. If two machines are running in parallel all the six ammeters may be reading exactly alike, although one machine may be motoring the other, and one set of ammeters registering not output, but

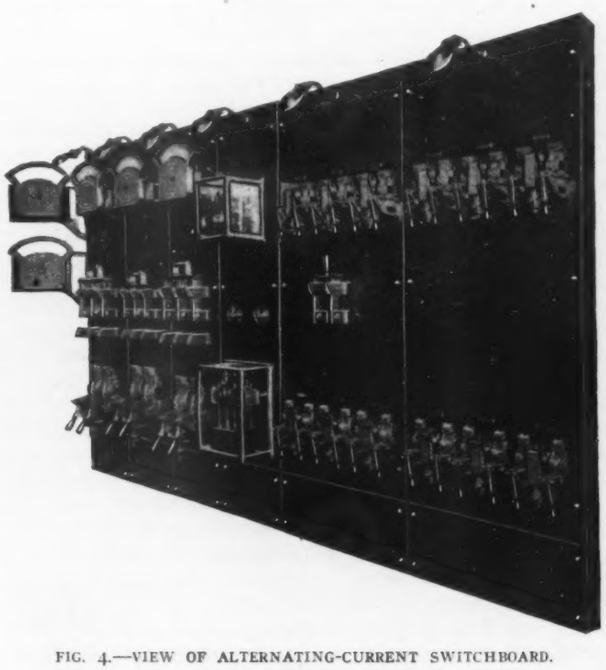


FIG. 4.—VIEW OF ALTERNATING-CURRENT SWITCHBOARD.

input, all of which the indicating wattmeter will be sure to point out.

All first-class panels should be in three sections: about 20 in. for the top, 48 in. for the middle and 20 in. for the foot section. Standard width appears to be 32 in. There will be one panel to each generator and one each for lamps and motors. In Fig. 4 is shown a fair board for a small installation having a mixed load. On these small boards there is no need of the expensive central-station instrument costing from $50 to $300 each. Neither ammeters nor voltmeters should cost much over $20 each. As this board controls lamps as well as motors in about equal proportions, it is worth while to have three ammeters, since the lighting loads are often very much out of balance on the different phases, and they are accordingly mounted on the top section. On the central section are the exciter voltmeter and ammeter, the generator-field switch, synchronizing lamp, voltmeter and synchronizer plugs, concentric rheostat handles and main three-pole switch. The concentric mounting of generator and exciter-field rheostats is a feature well worth while. Both are then under the hand of the operator, a valuable factor in quick balancing of the load. The generator resistance controller is mounted on a spider behind the board and carries the exciter rheostat on its back.

On the edge of the first generator panel is secured a swinging bracket carrying the bus voltmeter and the incoming machine voltmeter, which latter is connected to the voltmeter plugs of all the generator panels. By this means the voltage of any incoming machine can be adjusted to match that of the busbars. The illustration shows a second bracket carrying a spare voltmeter and a synchroscope. While the former is useful so long as thunderstorms continue in business, the latter is not worth its cost in a small plant, and even in a large one is of little use except to the engineer at the throttle of the incoming machine. No switchboard man would depend upon one to get his moment to throw in the switch, as most synchroscopes will point to zero with the lamps anywhere from dull red to black, and either coming in or going out of phase.

In laying out lighting panels, a single ammeter to each phase is advisable if the three lamp circuits start at the board. These circuits should be as near balanced as possible for the sake of greatest efficiency in running, but practically it makes no difference whether balanced or not, and one phase may have no current on it at all. The machines will continue to run month in and month out, only the plant is losing a little in efficiency and the wiring should eventually be arranged to balance all three circuits.

The motor panel should have as many three-pole switches and as many three-pole circuit-breakers as there are feeders. Each should have a watt-hour meter of the round switchboard type now on the market. This not only tells the operator at once whether energy is being used on that line, but also approximately how much, and at the end of the month saves much friction in charging the energy against the various departments. In a small board it is possible to combine the motor and lamp panels in one by mounting an indicating wattmeter in a swinging bracket together with the ground-detector voltmeter. In this case the panel would have the lamp ammeters on the top section and the motor and lamp switches and circuit-breakers mounted on the middle section, the circuit-breakers and switches being placed in horizontal rows, the former being in the bottom row. As regards the ground detector, there is still room in the market for a detector that will not ground one side of the system, thus cutting the available insulation in half. The static ground detectors listed are, of course, not to be thought of with the ordinary industrial plant. All the wire in the system would not furnish capacity enough to get anything reliable out of the detector. To date, the old-fashioned method of grounding the three legs of the system at the noon whistle through a three-point switch and voltmeter appears to be the only dependable scheme.

Assuming that the instruments have arrived, the first thing to do is to unpack them, and here is where trouble enters. One make requires every panel to be drilled with a small hole to pass a back-connected ground wire. Another make has the moving parts securely tied up, but nothing is said of this, so the electricians are liable to connect them in and close the circuit without taking off the carefully sealed case to investigate. These instruments have a small oil tube which is inserted after the instrument is set up on the board, which tube acts as a dead-beat dampener. There is also a small rider which will load the needle down to a red mark if the instrument is properly mounted and has not been damaged.

No matter which make is purchased, all should be rung out with the magneto and all the fuses tested. The voltmeter resistance is apt to have one of its fine wires broken; the ammeter may be open-circuited; the instrument transformer fuses may be inoperative; and one should know these things before turning on any circuit. The really interesting part of the board is the back of it. The three busbars are mounted horizontally side by side in heavy slate holders secured in cast-iron brackets bolted to the angle-iron framing of the board. It is advisable to tape and shellac the buses and all the leads to them from the machines and feeder switches for safety in working behind the board. Furthermore, electricians are prone to do careless things, such as leaving a screwdriver or wrench on one of the buses and forgetting all about it, until the main switch is thrown. On boards where the buses are alive all the time the danger comes from men working behind the buses with either a screwdriver or small wrench and getting badly burned from some inadvertent short-circuit in spite of all their care.

The first things to connect in are the main machine leads. One should be very careful to see that the A, B and C leads always enter the same busbars. Before synchronizing try the machines, one at a time, on some motor out in the works. If the motor reverses with any one of them, that dynamo's leads are crossed. The exciter leads should also be followed out to see that the positive always runs to the same side of the generator field switches. This may be tested while running by putting a compass under the positive wire. Its north pole must always stand on the same side of the wire. An indication should be made on the wire for future reference when once its polarity has been ascertained.

After following out and connecting in the field resistance leads, one can go over the work on the generator resistance. This is a cast-iron grid affair which is separate from the controller, and is mounted on a spider back of the board. The best thing to do with these grids is to bolt them to the wall in some convenient spot back of the board. Cover the whole set with No. 18 galvanized sheet iron, turning the iron over the top in a hood to provide ample ventilation and to keep dust from settling on the grids. There are some 50 taps on the grids which connect to corresponding buttons on the controller by means of the wire furnished. Every separate grid should be first rung out with the magneto. Being cast iron they often break in shipment, and as the break is usually inside the eye cannot detect it. The resistance being in series, any break will cut out all the sections until the controller passes the break. Then the exciter load is suddenly thrown on the generator with resulting excessive over-voltage. If the generator is a large one the grids will come in separate frames, about 25 grids in each frame. There are two extra taps in each frame marked A. The wiring diagram explains nothing about this, but by going into a trance one can surmise that A probably means "addition" and connect the two frames by a wire joining these taps. Of course, the controller leads connect the grids, but do not connect the sets, though it appears that way at first sight. The last thing to do with the resistance grids is to look them over to see that the electricians have left no washers, nails, bolts or other short-circuiting material lying on them.

The board is now ready, except for synchronizer and wattmeter connections. The former are simple enough, but require close watching to insure that the leads are never crossed. Two small voltage transformers are mounted on the back of the board. The line-voltage side of one is connected to the

buses and the line-voltage side of the other is connected to the synchronizer plugs of each machine. The pair of leads from each machine has a tap to the synchronizer plug of its own panel. The low-voltage leads of the two transformers are connected to each other through the synchronizing lamp. Now, the synchronizer plug is a reversing device in most boards, so that the current from any incoming machine flows through its transformer in the *opposite* direction to the current flowing through the transformer on the buses. So that if the incoming machine is in phase with the busbars, the two voltages in the transformer will be exactly opposite, so that no current will be produced and the lamp not be lighted. As the machine runs out of phase with the buses, the more in unison become the two voltages in the transformers so that finally they are in the same direction and the lamp lights to full brilliancy, the machine being completely out of phase. The engineer at the throttle of the incoming machine can usually place the speed so that the machines will slip one pole in about eight seconds, which is ample time to throw in the switch when the lamps are dark. When placing a new machine in service, one cannot be sure that the lamp is so connected as to be dark at the full-in-phase position except to connect it on its own panel. The two transformers are now on the same machine, the leads to the synchronizer plug, and are in phase so that the lamp should be dark. If it is not, one should cross the leads to the synchronizer plug. The synchroscope will indicate zero at either full-in or full-out of phase, so that one cannot be reasonably certain which is which except by the lamp trial. A good precaution to take with any incoming new machine coming on for the first time is to disconnect its leads to the buses and fuse them to the buses with 100-amp fuses. These will blow sharply if any mistake has been made in either transformers, phase rotation or identity of leads, but will hang on for some time if the machine is connected in right.

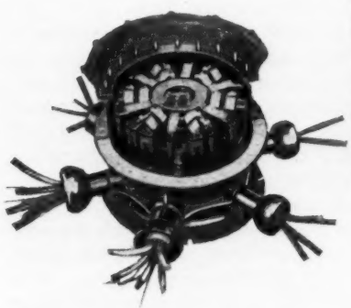


FIG. 1.—EDISON TYPE JUNCTION BOX.

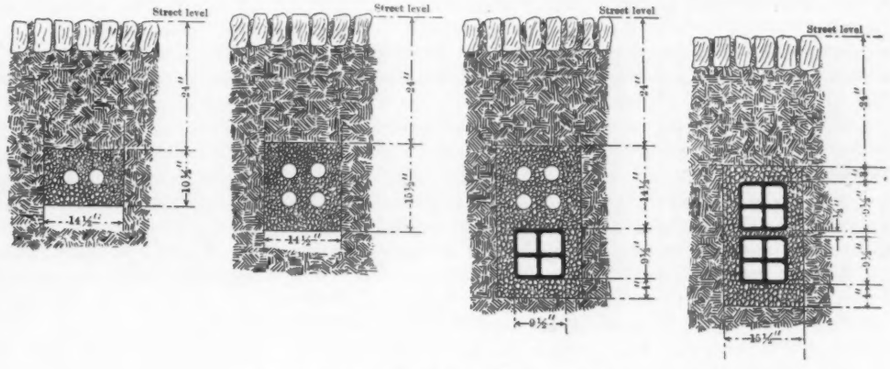


FIG. 2.—TYPES OF DISTRIBUTING CONDUIT.

For material and finish in industrial-plant boards the handsomest and easiest to keep looking well is black enamel. It sets off the polished copper-work and the black finish of the instruments very well and will not take oil stains or look dusty and greasy as marble often does. Green or purple Vermont slate, 2 in. thick with 3/8-in. bevel, gives a board free from cracks, loose cleavage and iron veins. For small low-tension panels blue Pennsylvania slate will answer. The various marbles are none of them very pleasing in proportion to cost excepting the white Italian, quarried in New York State, which is very fine for panels and, because of their location, must be more or less showy. The pink Tennessee marble soon looks very dirty and the blue Vermont always gives an unsatisfactory color scheme. Given the slate it is an easy, though not very economical, matter to make a board. Slate is drilled with an ordinary twist or blacksmith's drill and carpenter's brace, requiring no other pressure than a man's own weight. False holes can be plugged up with neat cement and a very presentable panel for some out-of-the-way generator or synchronous motor made up out of an old panel, no matter how holey. A "satinized" finish can be given it with shellac and lampblack.

The Arrangement of Underground Conduit for Electrical Distribution.

BY SYDNEY W. ASHE.

IN the Edison underground tube system of electrical distribution, which has been in use for many years throughout the United States, the conductors are enclosed in iron conduits before being buried in the ground. This system, while serving the purpose for which it was originally designed, has many disadvantages, principal of which are its lack of flexibility and its excessive cost of maintenance. These disadvantages have given rise to the development of the underground drawing-in conduit system of electrical distribution, which is rapidly becoming the standard system in places where the conditions warrant the high initial cost. The use of underground conduit systems of distribution is not alone confined to electric lighting systems, but is also used with modifications by electric railway and telephone systems. While the following descriptions apply principally to lighting systems, much of the data pertaining to conduit construction applies equally well to the other systems.

The underground conduit system consists of pipes or ducts made of iron, clay tile, wood, fiber or other material laid underground, with manholes, handholes or service pipes for access, and form a complete underground cableway between generating station, substations and customers' vaults or cellars. In other words, by this system it is possible when the conductors are installed to distribute power to the consumer from the main power house through an entirely underground system.

Sometimes an entire distributing system has overhead construction, while in other cases it is partly overhead and partly underground; but where the community is well built up, large parts of the system are usually underground.

Before describing in detail the drawing-in conduit system of distribution it is perhaps well to give the following brief description of the circuits of a modern lighting system: Starting from the main power house, considering an underground system, a series of passages or underground conduits convey three-phase, high-tension, alternating current at 6600 volts, 25 cycles, through lead-covered cables, three conductors in one sheath, to the substation. There it is lowered in voltage by transformers, converted into direct current, at 240 volts, and a three-wire system is produced by means of balancers and storage batteries. From the substation two-wire concentric cables carrying 240 volts pass through underground conduits to the manholes located on street corners, in the middle of a block, or in other suitable places. For several two-wire cables, one single neutral feeder is run to the manhole from the substation. It is the aim of the lighting company to have both sides of the system balanced, in which case there is no current in the neutral feeder. This condition, however, is not stable, so it is always necessary to run at least one neutral. To make this point clearer, suppose that four concentric cables, two-wire, of 1,000,000 circ. mil, 240 volts, are installed, then it would be desirable to install one 1,000,000 circ. mil cable as a neutral. Sometimes the light-

ing system becomes very much unbalanced, as in places where private plants have been abandoned for the lighting system, in which cases it may become necessary to run an extra neutral feeder in order to maintain proper voltage regulation. From the manholes, the feeders extend to junction boxes, close by, the Edison type being used. It might be interesting to state here that this is the only element of the Edison tube system which is now being installed in new work, and this is now being superseded by a new form of cable box termed the 1908 box. (See description given later.) The internal construction of the Edison junction box (Fig. 1) consists of three metallic rings, supported and insulated from each other and from ground, to which are connected the two concentric cables and the neutral feeder composing the three-wire system. These junction boxes have air-tight covers, so as to prevent water leaking through into them. They are connected by double sets of short lengths of pipe to the manholes for ingoing and outgoing cables. The distributing conduits also terminate in the manholes. These distributing conduits are shown in Fig. 2, where they are represented by 3-in. circular holes above the 3.5-in. rectangular openings of the feeder-conduits. In former years considerable trouble was experienced with the regular Edison junction box, as no method had presented itself for properly ventilating the box. The result was that gas would accumulate, become mixed with air, and explode when some of the terminals became loose and blow off the top of the manhole. With the modern system of connecting the junction box to the manhole by a short length of open pipe, the manhole having a sewer connection and a ventilated cover, it is hoped that no further trouble will be experienced in this direction. Inspection every three or four weeks, opening at the manholes, has also reduced this trouble to a marked degree.

The manholes are connected directly to the distributing ducts. which extend through the streets in front of the customer's premises. A service box is installed for about every five or six houses, the distributing ducts connecting them all together with the manhole. From the service box iron-pipe conduits extend into the customer's premises. Through each service connection are drawn three lead-sheathed cables which vary in size from a No. 8 B. & S. gage to a 1,000,000 circ. mil cable. With the smaller size cables the three of them, constituting the three-wire system, are drawn through the same iron pipe. With the heavy service connections separate pipes must be used. This pipe is 2.5 in. in diameter, and is not embedded in concrete. The three cables are connected in the service box to the mains and at the other extremity in the customer's cellar to the service cut-out and service switch. When the service connection is made both ends of the service pipe are plugged with waste and sealed with plaster of paris mixed with cement to prevent gas from leaking up from the subway to the customer's cellar. Formerly cement was used, but it was discovered that the cement combined in time with liquid acid refuse in the earth and destroyed the sheathing of the cables. The use of plaster of paris mixed with cement prevents this action.

PRELIMINARY PLANS.

For some cause or other the demand for an installation of a distributing system arises in some department of a lighting company. This demand may not necessarily mean the construction of an entire system, but may relate to any particular part of the system. It may be a subway, an extension of the distributing mains, a new service for a customer, or any one of many other demands. When this demand arises an inspection is made and a preliminary estimate of the cost of work is prepared. In making an estimate the work may be considered as being done by the company's staff of employees, or part of it may be considered as being let to contractors. It is very difficult to make an accurate estimate of the probable cost of subway construction, for there is no method of predetermining what obstacles in the nature of pipes may be encountered, although in some cities plans have been prepared by the city authorities showing the location of gas, water and sewer pipes, telephone, telegraph or electric-light conduits, and any other pipes or subways which are installed in the various streets. This system is now being instituted by the Public Service Corporation of New York for streets in which there are proposed railway subway lines.

Preliminary estimates with costs, plans and details of the proposed work are then sent to the general superintendent of the company for consideration. When the work has been finally authorized, the permits for opening the streets are obtained from the city authorities. At least three permits have to be obtained in a city like New York before the work can be done: one from the Department of Water Supply, Gas and Electricity permitting the installation of the subsidiary pipe, which permit is known as the authorization; a second from the same department permitting the installation of the cables in the subsidiary pipe, known as the pulling-in permit; and a third from the Bureau of Highways allowing the opening of the street. Should the pavement of the street be either asphalt or wood-block, a permit must be obtained from the pavement company having the maintenance contract, before any action will be taken by the Bureau of Highways. Again, should the street be under the jurisdiction of the Park Department, for example, Fifth and Eighth Avenues from Fifty-ninth to 110th Street, Riverside Drive and Seventy-second Street, or under the jurisdiction of the Dock Department, such as South, Marginal or West Street, additional permits must be obtained from these departments. Bids are then advertised and contracts let, such materials as the company is to supply are ordered by the purchasing agent of the company, providing sufficient materials are not in stock, and the work commences. As the first point in the construction of a subway system is the excavation, the following details are given:

Excavation.—When about to make excavations, the streets to be opened and all things concerning the manner of doing the work are determined by the company's engineer. The actual work is usually done by contractors. Should the work be done by the company's own employees the following details would apply to the company instead of the contractor: The contractor makes all excavations for laying the conduit and when the conduit is properly installed and inspected, refills all excavations and replaces the paving over them in accordance with the current specifications for that class of work of the Department of Highways of that borough. This statement applies to a large city like New York. He also keeps the streets in repair for one year, and cleans and sprinkles them until released by the Department of Highways and the Street Cleaning Department. During construction the contractor does all ditching, bailing, sheeting, shoring, guarding, lighting and watching, besides making all provisions necessary for maintaining and protecting all buildings, poles, sewers, railroads, subways and other structures, and repairs all damage done to them as well as providing and maintaining all bridges, fences and other means necessary for the maintenance of travel on the streets in which the excavations are made. He also provides convenient access to stores and dwellings of abutters, refills all excavations and resurfaces streets, carts away all rubbish and surplus material, furnishes all materials (except castings for manholes and boxes), tools, implements of labor and completes the work subject to the approval of the company's engineer and is subject to his direction at all times.

Proper plans are furnished by the company to the contractor showing in detail the work to be done. The drawings and specifications should co-operate so that no confusion of instructions will result. The material excavated from the trenches, and that used in the construction of the work, must be deposited so as not to endanger the work and so that free access may be had at any time to all hydrants, catchbasins, manholes and other necessary places in the vicinity of the work, all material from the trenches being deposited at least 18 in. from the trench and on one side only when so ordered. As the work progresses all surplus dirt and other useless materials from the trench should be removed by the contractor. The trenches and excavations should be refilled with the rest of the excavations, spread in layers not to exceed 6 in. in depth, thoroughly tamped and freed from stones. The surface of the

streets, including roadways and sidewalks, should be left in as good condition as before the excavation began. When streets are tunneled, they must be broken through and thoroughly tamped.

The depth of all excavations for conduits should be such as to leave a space at least 24 in. between the top of the concrete over distributing conduit and the street surface. The excavation should be of sufficient width to give at least 3 in. clear on each side of the conduit. The trenches when completed should be straight and true between adjacent manholes and so graded that water will flow into one manhole. In the Borough of Manhattan, New York, the city ordinance requires 4 ft. of clearance over the manholes (See Fig. 3), to allow for water pipes and gas pipes. This makes the total depth of the manhole quite large, about 12 ft., so to decrease the cost of excavation ducts are buried in the street at normal depth and slanted down at the manholes (see Fig. 3). The excavation should also be free from foreign pipes. Sometimes obstructions are encountered, in which case a manhole is constructed near the obstruction. As previously stated, the line of conduit must be straight for it would otherwise be difficult to rod the ducts and draw in the cables. Where single tile is used it can be built in around some obstructions. When it is necessary to prevent caving-in, the sides of the trenches should be supported by suitable planks and shoring, and the trenches should also be kept clear from water by draining, pumping and bailing.

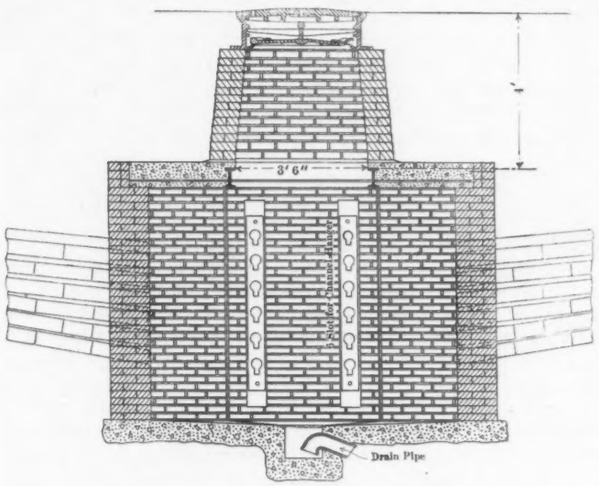
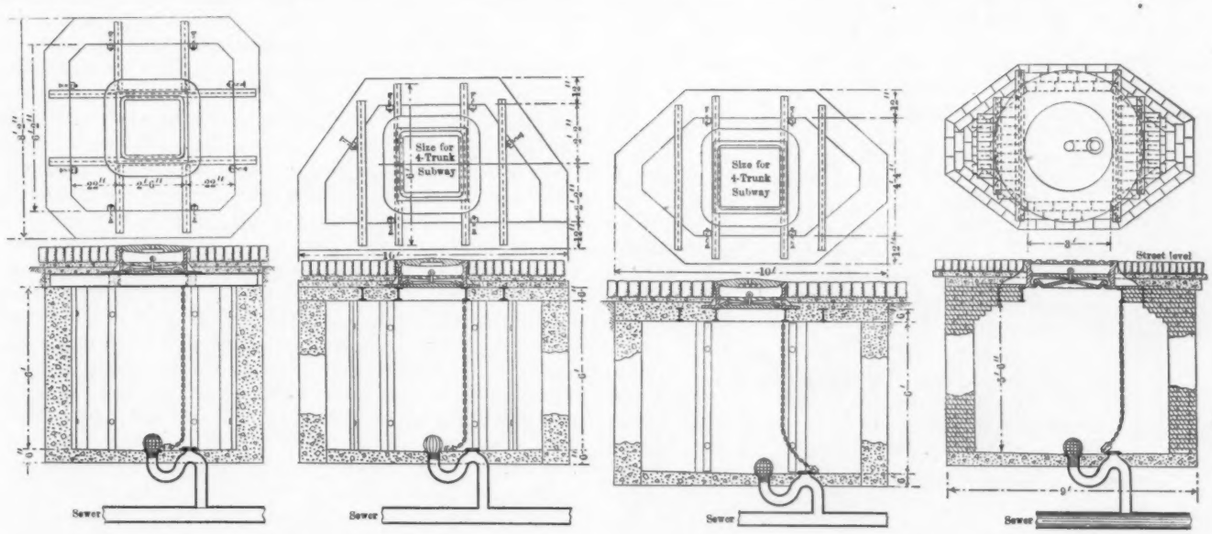


FIG. 3.—SECTION OF BRICK MANHOLE.

Wherever it may be necessary to interfere with the service of any street railway or steam railroad of a foreign company satisfactory arrangements should be made between the railway company and the contractor for properly protecting its traffic. Should any accident occur due to a defective condition of the street surface where the excavation has been made during a period of one year after the work is completed, the contractor should be liable and not the operating company for whom the work is being done. All gutters, curb, flag and paving stones which may have been displaced during the progress of the work should be reset, and when broken should be replaced, the work being done by first-class pavers. In laying out the possible line of the conduit, test-holes should be dug, one at the center of each block and one on each intersecting street corner, to ascertain the location of foreign pipes. Where rock is encountered, it should be removed, blasting when necessary, care being taken in such cases to prevent damage by carefully covering the blast-point with heavy timbers. Rock should be removed without blasting when there is danger of injuring gas pipes, water pipes or electrical conductors which are in close proximity.

Conduits.—Vitrified conduit is used almost exclusively at the present day for underground conductors, and therefore the descriptions below will be confined to this type. Conduit may be single duct, four or six multiple duct. They are 3.5 in. inside measurements, 18 in. long for single duct and 36 in. long for multiple duct. The bore of the conduit should be square and should have maximum and minimum dimensions of 3.75 in. and 3.83 in., respectively. The conduit must be straight, true and free from cracks, burrs, holes or other imperfections and should be thoroughly and evenly burned, vitrified and glazed, and free from iron. In fact, the interior surface must be free from any imperfections which will injure the cable when being drawn through, and which will not properly protect the cable when once installed. When laid end to end, the conduit must be square and true, dowel holes being opposite each other. Dowel pins are used with each length of multiple duct. Conduits are usually delivered at the point where they are to be used, the contractor being responsible for them from the time of delivery. Should any conduits be broken on delivery, the contractor rejects them, being in turn responsible for those broken after delivery.



FIGS. 4, 5, 6 AND 7.—CONSTRUCTION OF MANHOLES.

Circular fiber conduit and iron-pipe conduit is now being used by some companies for the distributing cables. The fiber conduit is usually of the slip-joint type and is 3 in. inside measurement. The iron-pipe conduit is lap-welded, 3 in. inside measurement, 0.21 in. in thickness and is of 7.45 lb per foot

nominal weight. It should be straight, true, free from scale or other imperfections which will injure the cable when being drawn through.

Subway Construction Details.—When the trench for the subway has been properly dug, inspected and passed, a grade stake should be located in the middle of the bottom of the trench at suitable intervals. The side frames should then be put in place with their keeper. A layer of concrete 3 in. in depth should next be placed in the trench, coming to the top of the grade stake. This concrete should consist of one part of Portland cement, three parts of sand and five parts of broken stone, the sand and cement being thoroughly mixed before putting in the stone. Use should be made of a good grade of sand which is free from loam, clay or any foreign substance. The stone may be trap-rock, granite or limestone which is free from dust, and must be of such a size that each piece will pass through a ring 0.75 in. in diameter. The sand and cement should be thoroughly mixed before putting in the stone, and when the stone is added the whole mass should be turned at least five times on a mixing board before placing in the trench. The tensile strength of concrete when hard is affected to a marked degree by the manner in which the materials are mixed. When the mixture has been placed in the trench it should be thoroughly tamped with wooden rammers until water appears on the surface. The concrete bottom of the trench should extend from manhole to manhole and the full width of the trench, and should set for 12 hours before the conduit is laid on it. Where fiber conduits are laid they should be placed horizontally, filling in around the sides and bottom with concrete. Where vitrified conduit is installed it should be laid straight and true and a mandrel should be used to align each duct. The conduit should be aligned also. No offsets are allowed except by consent of the company's engineer. All joints, except iron pipe, must be wrapped with unbleached muslin 5 in. wide and to overlap 10 in. on tile and 4 in. on the fiber conduit. Ducts should be laid so as to break joints, the entire joint being covered with a 0.25-in. layer of well-worked cement, one-half sand and one-half cement. When the subway is completed it should be tested by a mandrel 3.25 in. in diameter and 4 ft. long, pulled through each clay duct, and a mandrel 2.75 in. in diameter and 4 ft. long pulled through each iron or fiber duct. Any duct which is foul and will not allow the mandrel to be pulled through should be removed and re-

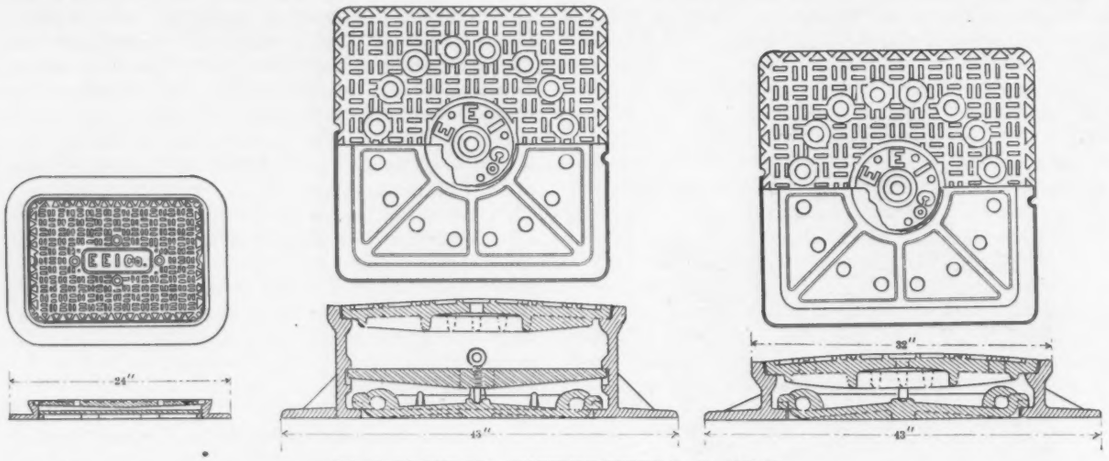


FIG. 9, 10 AND 11.—MANHOLE COVERS F_2, F_3 AND F_4

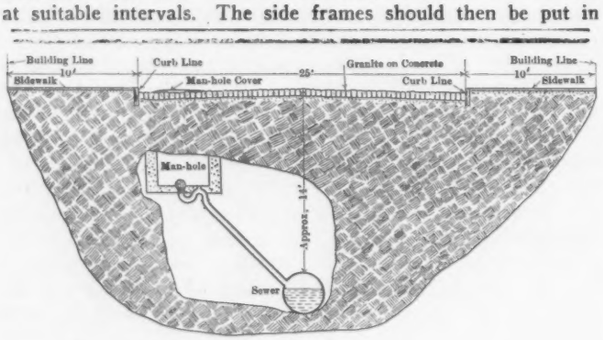
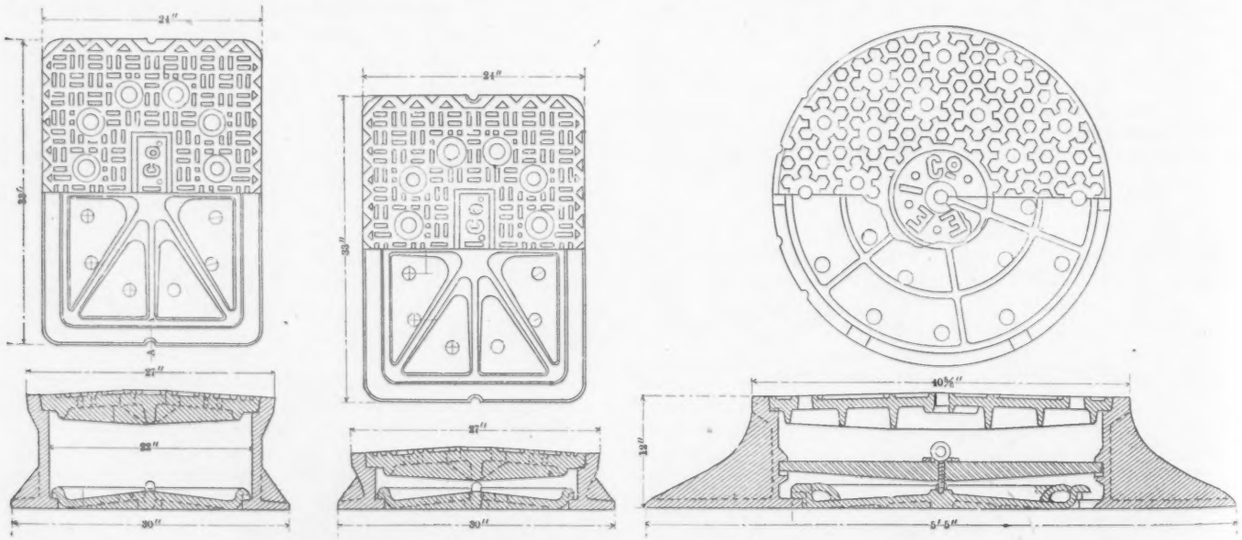


FIG. 8.—SEWER CONNECTION WITH MANHOLE.



FIGS. 12, 13 AND 14.—MANHOLE COVERS F_5, F_6 AND A.

placed at the contractor's expense. When the conduits have been laid in position, prior to testing, a 3-in. thickness of concrete should be placed on both sides of it, boards being used to insure the desired thickness. A top layer of concrete 3 in. in thickness should then be installed. All concrete should set at least 12 hours before refilling the trench and resurfacing the street according to previous instructions. When it is desirable to use four-fiber ducts the retaining frame should be raised and two more ducts should be inserted. The trench should then be filled.

Above the feeder conduits are usually built the distributing ducts, as shown in Fig. 2. By having both the conduits and the distributing conduits in the same trench considerable expense in original construction is saved. These diagrams, Fig. 2, give all of the dimensions for the construction of standard subways. The details of the cost of this type are given below.

Manholes.—The location for manholes is usually decided by the company's engineer, the contractor digging at specified points a test-hole, at least 5 ft. deep, from the curb to the center of the street. Care must be taken to insure that no foreign pipes are in the manhole. Should any occur they should be removed to some other location, the cost of the removal being paid for as extra work. Manholes may be built of concrete or brick. Various forms of standard manhole construction are shown in Figs. 3, 4, 5, 6 and 7. Fig. 4 approaches the rectangular form. Fig. 5 is used when the space is confined and Fig. 6 is used most frequently for large subways. While many of the details of manholes may be specified, such as the casting for the top, sewer connection, location of cable-clamps, etc., it is seldom that the shapes of manholes may be made to conform to standard size owing to the many obstructions encountered in locating them. The writer has in mind one instance in a congested community where a line of subway was constructed in which out of 47 manholes only four could be made to conform to an original standard, the remainder calling for special construction and having irregular internal shapes. Rectangular manholes are not entirely satisfactory, because in fastening the cables in the cable-racks on the side of the manhole, the workman in order to make a neat piece of work will endeavor to use pipe or wood to make a rectangular bend in the cable as it comes from the duct, resulting too often in injury to the cable. A coffin-shaped interior, as shown in Fig. 7, serves to excellent advantage in obviating the above-mentioned difficulty. Each manhole should be provided with a sewer connection, as shown in Fig. 8, which in itself should have a trap to keep the sewer gas from entering the subway system. When this happens there is danger from explosions. The bottom of the subway should be graded so that water will flow toward the sewer connection. Ball screens, made of No. 6 galvanized wire (iron), with meshes close together, should be mounted over the trap, as shown in Fig. 8. A 4-in. wooden plug, thoroughly soaked in paraffin or oil, with 5/16-in. galvanized-iron bolt through the center, and a ⅜-in. galvanized-iron chain to fasten to the top of the manhole should be installed as shown in Figs. 4, 5, 6 and 7. In recent manhole construction, plug-and-chain connection is being omitted, as involving unnecessary expense. When constructing the manholes, double wooden frames are installed and concrete is rammed in between the two frames, thereby making a very substantial wall. When the concrete of the side-walls is set, and the sewer connection has been made, the side-frames are taken out and the concrete bottom is installed. Iron I-beams to support the top of the manhole are next put in place, concrete being placed around it and the cover arranged in position. Cable-racks are also installed on the side walls.

The various sizes of manhole heads are installed depending upon the size and the location of the manhole, and also whether it will be located in a street containing cobble or asphalt, a 12-in. deep head being used for one purpose and a 6-in. deep head being used for the other. It is the practice of some companies to use several types of manhole heads, known as the F_2, F_3, F_4, F_5, F_6 and A heads, as shown in Figs. 9, 10, 11, 12, 13 and 14. The F_3 and F_4 heads are used most extensively for ordinary work, the F_3 head being used for cobble and the F_4 head for asphalt. Where the manhole is built in a narrow place, such as a space between the car track and the curb, use is made of an oblong head, termed the F_5. If the manhole cover must be large enough to admit transformers to the manholes, use is made of a large circular head, known as the A type, illustrated in Fig. 14. The head is shown in position in Fig. 7.

In a subsequent article a description will be given of a recently developed type of junction box, after which cost data will be discussed in detail.

The Prevention and Removal of Boiler Scale—I.

By W. H. WAKEMAN.

WHERE effective measures are taken to prevent the formation of scale in boilers there would seem to be no necessity for devising ways and means for its removal, but this statement does not cover all points to be considered in this connection for the following reasons: If the steam boilers in a plant are new and free from scale only a preventive is needed, but where they have been used for several years and no special effort made to prevent the accumulation of foreign matter in them, a remedy is certainly needed, and at the same time care should be taken to prevent other scale from forming on the tubes and shell. In the case of a water-tube boiler, the sediment from impure water collects in the tubes, but the effect is the same, as fuel is wasted and boilers are worn out much quicker.

It is a fact worthy of careful consideration that if pure water is used in boilers it not only prevents the formation of scale, but natural conditions combine to dislodge and dissolve what was there, before pure water was substituted for that which is heavily charged with scale-forming impurities. Many manufacturers and steam users believe that if water is "clear as crystal" and appears to be suitable for drinking purposes, it must necessarily be just what is wanted for making steam, but this desirable state of affairs is not always realized in practice because some of the most objectionable impurities which have to be dealt with are not separated and thrown down until the temperature is raised above the boiling point.

There are two plans for introducing a compound for disposing of scale, one of which is to place a large quantity of the substance in the boiler at once, and the other is to send in more or less every day according to conditions. In some cases this is done during an hour (more or less) of running time, while in others it is continued through all of the time that water is going into the boilers. This applies to resolvents that are bought in solid form and dissolved in water, as well as to those that are sold as liquids. It requires intelligent investigation and good judgment to decide where to draw the line between purchasing a solid that is adulterated with harmful ingredients and a liquid containing a large per cent of water that might as well be secured from the nearest faucet free.

If all of the water used is "softened" no special restrictions need be laid on the quantity treated at one time, but if a certain quantity of resolvent is intended to go into a boiler to act on the water in it, care ought to be taken to know that all of it is properly delivered, not only because these compounds are usually sold at high prices, making it expensive to waste them, but in addition to this consideration is the more important fact that the omission or extraction of one ingredient may entirely change the nature of the remaining compound.

For illustration, the boilers of a certain plant were fed from a large tank during a portion of the time, and as they already contained some scale and more was accumulating, the owner purchased a compound in solid form, and the engineer put a prescribed quantity of it into the tank at stated periods. After several months of this service the tank was cleaned and a considerable portion of the compound was found at the bottom, as it had not dissolved. It is not probable that the portion which went into the boiler was complete as the inventor of it expected that it would be used as he delivered it. If the

result is not satisfactory in such a case the disappointment ought to be charged to mismanagement, not to the compound.

Another phase of this subject is illustrated by the following incident: A certain boiler was badly scaled and a quantity of dry compound was purchased to remove it, although no facilities were provided for introducing it into the boiler. As the engineer felt the need of some action in the matter, and he was accustomed to making the best of whatever situation he was placed in, he proceeded to cool off the boiler, get the water out and put a comparatively large quantity of the compound through the front manhole onto the first sheet, in a dry condition, as he did not consider it necessary to dissolve it in water. The boiler was refilled, fired up and used for a week, when it was again opened and a surprisingly large quantity of scale lay in a loose heap just where the compound was left. Of course, this scale came from all parts of the boiler, but it lodged directly over the fire. Fortunately it consisted of hard pieces which allowed more or less water to reach the plate. Had these been mixed with soft mud the result might have been disastrous, because it is more difficult for water to penetrate such a mass, hence there is danger of overheating the plate, and as hot iron is not as strong as the cold article, the pressure carried makes the hot portion bulge or bag, causing a dangerous defect.

Reviewing reports of 10 experiments made under conditions which resulted in comparatively small differences between the temperature of the furnace and of the water in the boiler shows that where the smaller difference was 301 deg. Fahr., the rate of transmission was 301 heat units per minute per square foot of heating surface. When this was increased to 848 deg. Fahr. the rate of transmission rose to 180 heat units per minute.

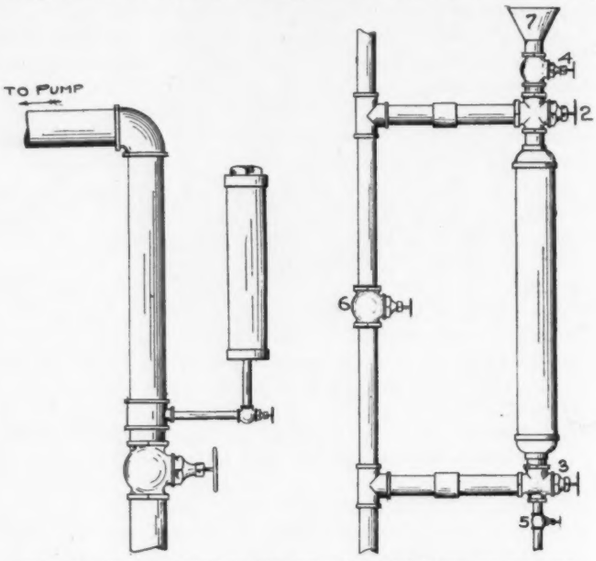
Taking the results secured by 10 other experiments in which the lowest difference of temperature between furnace and water was 1278 deg. Fahr., the rate was 446 heat units per square foot per minute. The highest difference was 1398 deg. Fahr. and the rate of transmission rose to 752 heat units. Inasmuch as a heat unit is sufficient to raise the temperature of 1 lb. of water 1 deg. Fahr., it follows that if water is delivered into a boiler at 212 deg. and raised to 352 deg. (which corresponds to a boiler pressure of 125 lb. by the gage), the latter rate of transmission is sufficient to raise more than 5 lb. per minute through this range. To evaporate water under the same conditions requires 1010 heat units per pound, therefore when the rate of transmission is 752 heat units per minute, or 45,120 per hour, nearly 45 lb. would be evaporated per hour, which represents about 1½ boiler hp.

While this rate appears to be abnormal, nobody can state positively that it is not approached, or even realized, in strenuous practice owing to the following conditions: In a certain very important case a boiler was tested to demonstrate its greatest possible capacity for evaporating water and it developed 1 hp for each 3 sq. ft. of heating surface. This included the whole boiler, but no boiler of an ordinary type has ever been built and put into service in which every square foot of heating surface is equally efficient in evaporating water, therefore, while the average in this case was 10 lb. of water evaporated per hour on each square foot of heating surface, it is quite possible that some of the heating surface was much more efficient than this indicates, while other parts did poor work accordingly.

The foregoing facts show that heat passes through clean boiler plate very rapidly, hence great care should be taken to avoid obstructions of any kind to retard its action, for if it does not pass freely into the water it will accumulate in the plate, which is not in accordance with good practice, hence the necessity for preventing the formation of scale.

Fig. 1 represents a very simple device for feeding compound into a boiler. It consists of a ½-in. nipple connected into the suction pipe of a pump, on the end of which is an angle valve carrying a short vertical nipple, followed by a reducing coupling. A piece of larger pipe, 2 ft. or more in length, is screwed into this coupling and a cap completes the device. The latter need not be put on tight, as it is only intended to exclude dust and give a finished appearance to the feeder. If the pump takes water from a well or a brook there is a partial vacuum in the suction pipe, therefore, when the angle valve is opened the atmospheric pressure forces the compound into the suction pipe. Where the supply comes under pressure through the vertical pipe, it is necessary to locate a valve below the feeder, as shown, and this should be partially closed when the compound is to be drawn into the suction or supply pipe.

Fig. 2 illustrates a more elaborate device for the same pur-



FIGS. 1 AND 2.—SERVICES FOR FEEDING COMPOUND TO BOILERS.

pose, to be used in connection with a vertical pipe. The body consists of a piece of pipe large enough to hold the required quantity of compound after it is dissolved or otherwise prepared for use. It is assumed that this is larger than the connecting pipes which ought to be equal to the suction pipe, therefore a reducing coupling will be required for each end, followed by a nipple and a cross valve, with another valve in the main suction pipe, as shown. This device is operated as follows: When it is to be filled close valves 2 and 3 and open valve 4. Valve 5 should be opened to drain out any water that may remain in the body and then closed again. If the pump is running valve 6 must be open. The device should be filled through the funnel 7, then valve 4 closed, valves 2 and 3 opened, and valve 6 closed in the order mentioned. This will

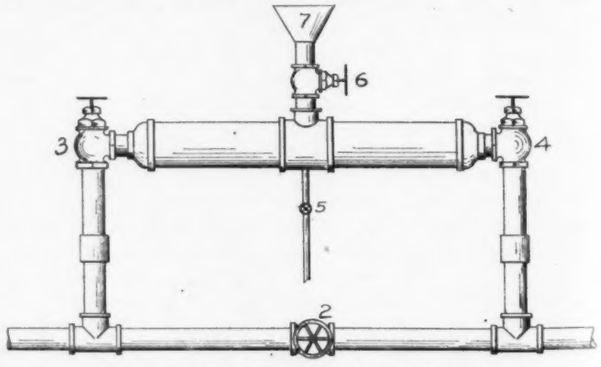


FIG. 3.—HORIZONTAL FEEDING ARRANGEMENT.

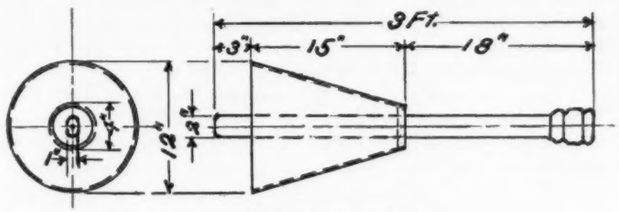
force water through the body and take the compound out with it.

Fig. 3 shows practically the same device, but it is intended for use in connection with a horizontal pipe, hence there are slight differences in its construction. The valve 2 is in the main suction pipe, while angle valves are used at 3 and 4. A drip valve is provided at 5 and a stop valve at 6, also a funnel at 7. The operation of this compound feeder will be understood after reading the description of the preceding illustration.

LETTERS ON PRACTICAL SUBJECTS

SAFETY COMMUTATOR BRUSH.

The accompanying illustration gives the details of a safety commutator brush for lubricating the commutators of rotaries and large direct-current motors while in operation. As is evident from the engraving, the brush serves as a protection to the hands and arms in case of a flash-over while the commutator is being cleaned. The brush is made from a 1-in. x 2-in. pine, 3 ft. long. Notches are cut in the side and a strip of canvas is wrapped and fastened in place near one end by cords drawn tight into the notches and then tied. A frustrum of a



COMMUTATOR BRUSH.

cone similar to the usual megaphone is then made up from light cardboard. The small end is closed by a circular piece of cardboard fastened in place with glue. The cardboard should have a slot cut in the middle of it just the size of the pine stick and should then be glued securely in place, as indicated. A device of this kind will be found very serviceable in connection with 60-cycle rotaries, which are prone to flash over at times.

LYNN, MASS. HOWARD M. NICHOLS.

A RAPID GRINDING AND SURFACING METHOD.

The scientific method of grinding a true surface is to place the object on the table of a high-grade surface grinder and then work off the superfluous metal with neatness and despatch and a soft emery wheel. But the electrician does not always have an emery grinder, to say nothing of having an expensive surface grinder at hand when wanted. The next best way is to use the surface plate. The mechanic procures a surface plate worth anywhere from $20 to $200 and smears it lightly with red lead in oil, or with lampblack or chalk, according to the nature of the article to be made true, which is then placed flat upon the coated plate and moved gently back and forth to rub some of the coating off upon the surface to be treated. Then, with chisel and hammer or file or scraper, the mechanic carefully removes those portions of the work which have been marked by the coating from the surface plate. This performance is repeated until the surface of the work has become sufficiently flat to answer the purpose. If it must be exceedingly true, then many repeated daubings and scrapings are found necessary, together with many replacings of the coating on the surface plate. The mechanic must take great care not to rub too much on the surface plate in the same spot, lest holes be worn in its surface and the plate thereby ruined for all accurate work. By a method described below all rough surfacing may be smoothed in a very short time with an accuracy almost equaling the grinding and surface-plate methods. In fact, the surface plate may be used with this method, but there is no danger whatever that it will be dug full of holes. For instance, let it be supposed that a 3-in. flange is to be trued up so that it will make a steam-tight joint with nothing but plumbago for packing. The surface plate is brushed clean of all dirt and dust, and a sheet of clean emery paper placed flat on the plate, with the emery side uppermost. The emery cloth, which may be either fine or coarse as required by the amount of metal to be removed from the flange, is held in place on the plate by means of the thumb and fingers of the left hand, while the right hand is employed in revolving the flange upon the emery cloth. The flange should be held firmly, yet permitted to lie perfectly flat on the emery paper while it is moved in small circles over the surface of the emery paper. Every few minutes the flange should be lifted from the emery paper, which, in turn, is removed from the surface plate and all the metal cuttings and worn-off particles carefully shaken from it, after which the operation is repeated again and again until the desired degree of accuracy has been obtained. Care should be taken to revolve the flange in the hand at least 60 deg. every time it is lifted from the paper. This brings the cutting of the emery in lines which cross each other and there is less danger in cutting down one side or edge more than the others.

SCRANTON, PA. JOHN JACKSON.

DEMAGNETIZING A WATCH.

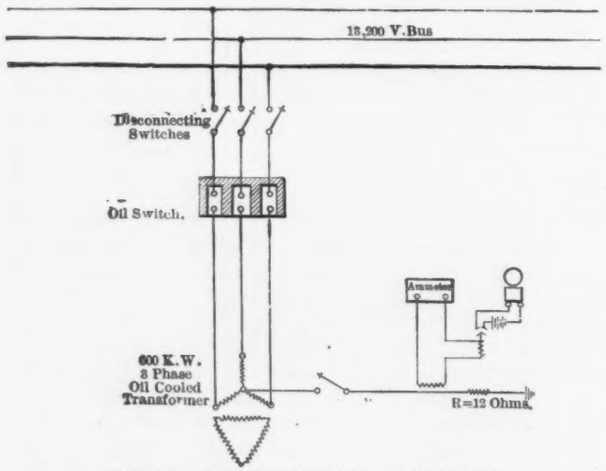
Not long ago I was shown through one of the new ocean palaces in company with a friend who was acquainted with the chief engineer, and in the course of our perambulations we went down into the electric-lighting plant, the size and equipment of which, by the way, surprised me, for I had no idea that an ocean liner possessed such a well-equipped electrical station, for aside from the lighting apparatus there is considerable electrical equipment for other purposes. I was naturally interested in this department of the ship and got into quite close proximity with some of the motors and dynamos. It then dawned on me that I had neglected to leave my watch upstairs, and I was sorry to think that it had become magnetized, for magnetized it was from the way it had already begun to act. The last time this happened to my watch it cost me a few dollars to get it into good running shape again, for I had to bring it to a watchmaker's, and, as is customary, he found several other things wrong with it besides the fact that it was magnetized. The engineer assured me, however, that it would not cost me any money or inconvenience this time, for he had a scheme of overcoming the difficulty that to me was quite novel. It was his method of demagnetizing the watch to which I wish to call attention. He strung the watch on a cord by passing it through the bow and held both ends of the cord between his fingers. He then turned the watch around and around with his other hand until the cord was pretty well twisted so that if the watch was released from his hand it would naturally unwind. Suspending the watch above the field structure of the dynamo so it was about three-fourths of a yard above it, he released the watch, thus permitting it to unwind, at the same time revolving it like a pendulum to and fro from the dynamo allowing it to come within a few inches of the machine. This process was repeated three or four times, which required very much less time than it takes to tell it, alternating on each pole of the dynamo, and the watch was returned to me with the guarantee that it would run as well as it ever did. I had my doubts about the efficacy of such treatment for magnetized watches, but to my surprise it had the desired result, for my timepiece continued to run accurately, after being set, and I have not had the slightest trouble with it ever since. Irrespective of what the explanation is, it occurred to me that this method may be new to some of your readers, and worth knowing as an interesting as well as a time- and money-saving means of demagnetizing a watch.

BROOKLYN, N. Y. L. F. HORTON.

[The method of demagnetizing watches usually employed by jewelers consists in suspending the defective timepiece by means of a twisted string between the poles of a horseshoe magnet. As the watch revolves rapidly it is slowly withdrawn from the magnetic field. The whirling motion, of course, changes the direction of magnetization and by drawing the watch farther and farther from the magnet the effect of the field becomes less and less and the intensity of magnetization oscillates between values first in one direction and then in the other, but continually decreasing so that when the watch is entirely removed from the field of the magnet the main spring is no longer affected. By slowly withdrawing a watch from the core of an alternating-current magnet the same effect is produced without any whirling motion.—EDS.]

GROUNDING A TRANSMISSION SYSTEM THROUGH A SPECIAL TRANSFORMER.

The installation of a large transformer for grounding the neutral of a three-phase transmission system in the middle West possesses features of interest. The company has three stations; a large modern steam station, and two water-power plants. The alternators in the older of the water-power stations generate current at 3500 volts, while the steam station and the new water-power station feed the transmission system at the generating pressure of 13,200 volts. The step-up transformers in the old water-power station, which raise the voltage from 3500 to the generating and transmitting pressure of the other stations, are delta-connected on both secondary and primary. During the part of the day when the lightest load occurs this station has ample equipment to furnish energy for the entire railway system, and therefore the steam station may be shut down. Since the transformers in the old water-power station are delta-connected, it has not been possible until recently to have ground connection on the transmission system while this station is carrying the whole load. To furnish a permanent ground for the entire high-tension system a large transformer with its primary coils star-connected and its neutral grounded through resistance has been installed in the steam generating station. The transmission cables to the substations



ARRANGEMENT OF GROUNDING TRANSFORMER.

all radiate from the bus compartments of this station and by means of the grounded neutral of this transformer there is a ground connection for the transmission system, no matter which of the generating plants may be in service.

The accompanying sketch shows the arrangement of the grounding transformer and its connection with the main high-tension bus of the distributing station. The transformer is of the standard self-cooling type of 600-kw rating with the primary coil star-connected and wound for 13,200 volts and the secondary coil delta-connected and wound for 440 volts. The secondary coil is permanently connected in delta with no exterior taps. Were this secondary to be opened the transformer would act only as impedance in the three-phase circuit. The frequency is 35 cycles.

The primary leads of the transformer are connected with the main high-tension buses of the power station through an oil switch provided with hand-operated disconnected switches. The oil switch is provided with operating contacts on the switchboard, but no automatic relay is connected in the control circuit. The midpoint of the star-wound primary is connected to ground through a disconnecting switch and a cast-grid resistance of 12 ohms. This amount of resistance restricts the current flowing to ground to a maximum of about 600 amp when there is a good ground on any other point in the high-tension system. A series transformer is interposed in the ground lead between the disconnecting switch and the resistance. This series transformer operates the coil of a relay, which is so adjusted that when current to the amount of 40 amp passes through the ground connection the plunger of the relay completes a bell circuit, thus giving an alarm. The relay adjustment is such that when the bough of a tree switches across the transmission line during a storm, or a bird gets in contact with the two sides of the horn arrester, the bell immediately rings. Double ground connections were made by sinking a plate below the water level of the river near-by and by making connection to the negative return cables of the railway system.

The installation of this large transformer for the purpose of grounding the neutral of the three-phase transmission system has been successful. Previous to the time when this transformer was put into service surges occurred on the transmission system, which resulted in troubles to the cable insulation being communicated from one point of the transmission network to widely varying points. Ordinarily such troubles originate because of a ground rather than a short circuit, and now, when such a ground occurs, the alarm bell operated from the ground connection of the transformer immediately notifies the switchboard attendant that there is trouble on some feeder line. He at once glances along the line of ammeters and can tell by the swinging of the needles which feeder is disturbed. The oil switch between this feeder and the main bus is immediately opened and thus the trouble is not communicated to the substations; and so far the operators have been able to open feeder lines on which the cables were grounded before the burning at the ground has become disastrous.

Practically the entire load on the transmission system consists of rotary converters, so the phases are balanced. All feeder lines leaving the power station have series transformers on each leg, so that no matter what phases become grounded the entire feeder is automatically cut out. The grounding transformer supplements this system of automatic overload relays and with the assistance of the switchboard operator defective cables are cut out before the short circuit or ground draws enough current to operate the automatic relays. It is reported that since this transformer installation has been in service there has not been a single case of "simultaneous" cable troubles.

Chicago, Ill. Henry Poland.

CYLINDER LUBRICATION.

It is quite evident from many practical examples that, considering the amount of oil used, cylinder lubrication is not what it should be. It is not impossible to find in many of the large power plants wastefulness in the use of lubricating oils, and despite this fact engines suffering from the want of sufficient lubricant. It is known that coal consumption may be increased or decreased in proportion to the lack of ampleness of lubrication on engine and other bearings; but this is one phase in economy testing that does not receive its full share of consideration. For instance, if a valve gear works heavy because of poor lubrication, the steam distribution is not likely to be accurate, especially if the engine is of the four-valve type. This leads to a lowering of efficiency in the steam plant, and a power-house man experienced a practical demonstration of this recently, when his engine slowed down under load, due primarily to the spring and torsion in the valve gear not permitting the respective valves to make their normal travel, thus affecting the steam distribution, with consequent decrease in speed, although the steam pressure was normal. It will, of course, be appreciated that some oils will not lubricate one engine as well as they might another, because of varying conditions. Superheated steam requires an oil with a much higher fire test than saturated steam. The condition of the water that the boiler is using may have some influence on the oil. The writer has known a boiler to prime, and the water carried over to have a chemical influence on the cylinder oil. In some cases a cheap oil will be more affected than an expensive oil. The writer can recall an instance where a black oil carried so much acid that it would not properly lubricate, and caused all of the joints to leak in addition. When the valve was taken out the surface appeared as though no oil had ever been used on the engine. By simply changing the oil the engine worked all right. If oil works out through the joints it indicates that

it contains acid. Tallow will have the same effect, because of the acid contained in it. The amount of oil used is no criterion of the lubrication. Some oils will not lubricate under any conditions, because they are not suited for the apparatus on which they are being used. In order to determine whether oils are performing their proper functions they should be carefully tested, and after specific runs some of the valves removed so as to determine their condition. With a good grade of oil

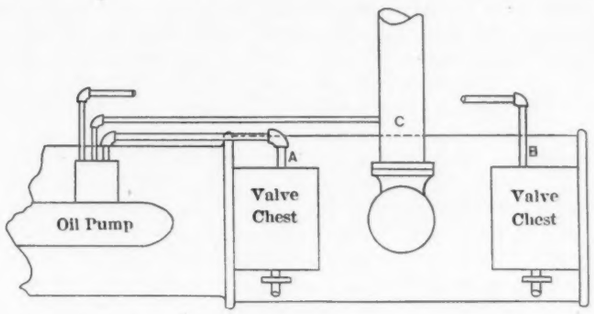


FIG. 1.—MULTIPLE-FEED OILING CONNECTIONS.

suited to the work, and all other conditions favorable, the valves and cylinder will appear nicely glazed. If the oil is not suitable, this will be indicated by the condition of the valves. Many engineers will pump oil freely into an engine cylinder just before starting, and permit the oil and water to pass beyond the valve chamber. A better practice would be to permit the lubricant to run freely for a short time before the engine is stopped; this will leave the engine in good condition for starting, and if more or less water is condensed in the cylinder and valve chambers at starting the lubricant is not carried off with the water. The point at which the oil is permitted to enter the engine has much to do with its effectiveness, and the writer recently had an opportunity of witnessing an interesting demonstration of this fact. Referring to Fig. 1, there is a multiple oil pump delivering oil through several pipes, two pipes running to valve chambers, and one to the main steam line above the throttle. It was found by actual test that oil passing over pipe *C* was much more effective than either of the others. By closing the pipes *A* and *B*, and slightly increasing the feed in the pipe *C*, best results were obtained. This was attributed to the fact that the oil entered the steam line above the throttle, and coming in contact with the steam was thoroughly atomized; while the oil entering the valve chambers came in contact with more or less water, and was not so thoroughly mingled as the oil entering the steam line. In Fig. 2 is illus-

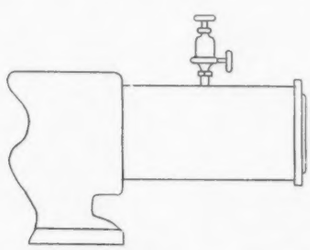


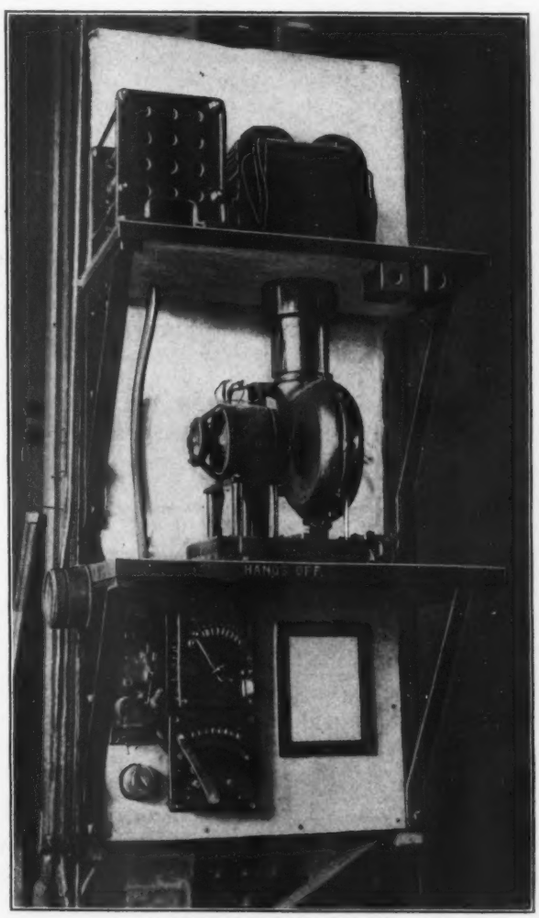
FIG. 2.—WASTEFUL METHOD OF LUBRICATION.

trated a practice often found, of allowing oil to enter the main cylinder direct, only to flow through the cylinder and out, which is a very wasteful method. The same oil permitted to flow through the steam pipe would not only lubricate the cylinder but the valves as well, and about half as much oil would be required. In a compound engine it is much better to feed the most oil to the high-pressure cylinder, for obvious reasons. The writer has found, however, that the same oil does not work as well on both cylinders, and that an oil giving a lower fire test is much to be preferred for the low-pressure cylinder.

RICHMOND, VA. C. B. MCGAHEY.

HANDY EQUIPMENT FOR SHOP TESTING.

In many repair shops it is desirable oftentimes to have alternating current for testing purposes. In a great many cities alternating curent is easily secured; but in not a few cases only direct-current is available. Rotary converters or motor-generator sets must, of course, be employed to obtain the alternating current in the latter case. Where 500-volt, direct-current power circuits are available the following equipment designed by the master mechanic of a Chicago railroad is applicable and may be duplicated without excessive cost. A similar scheme can be adopted with direct-current of lower voltage, although the data given herewith are only applicable to 550-volt, direct-current railway circuits. The converter and transforming outfit are shown in the engraving. The equipment comprises a small rotary converter with a step-up transformer, starting and regulating boxes and a fan. From this outfit alternating current is supplied for testing and the voltage can be regulated between the limits of 350 volts and 3000 volts. The complete set is mounted on the wall where it is out of the way and does not take up floor space. With the current available, the converting set was designed and built as follows: Energy is taken directly from the shop circuit, which is fed from the third-rail feeders. A large snap switch is used in connection with a 2-amp enclosed fuse and a small carbon-break circuit-breaker which protects the converting apparatus. From the circuit-breaker the current supply passes to a starting



ARRANGEMENT OF TESTING EQUIPMENT.

box which controls the small converter. This converter was made by adding two slip rings to a ½-hp, two-pole, 500-volt, shunt-wound motor. Two taps were brought out from the armature winding to the collector rings. The unit so arranged receives direct current at 550 volts and converts it to 375-volt, single-phase alternating current. For the purpose of giving severe breakdown tests to motor and armature coils it was

desired to have available a maximum voltage of 3000; therefore, a transformer was built. Its primary coil is connected direct to the slip rings of the small converter and in one side of the primary circuit a control rheostat and box have been placed. The box has nine points to which are connected a series of resistance coils similar to those used in the control circuit of a multiple-unit equipment. With these resistance steps in series with the primary of the transformer, which has 750 turns in the primary and 7050 in the secondary, it is possible to obtain 10 different voltages from the secondary terminals of the transformer. When the direct-current line voltage fed to the small converter is 500 volts the alternating-current voltage obtained from the machine is 350 volts and for each point on the box controlling the resistance in the primary circuit the following alternating-current voltages are obtained at the secondary terminals of the transformer:

Point 1	630 volts	Point 6	2030 volts
Point 2	910 volts	Point 7	2310 volts
Point 3	1190 volts	Point 8	2590 volts
Point 4	1470 volts	Point 9	2870 volts
Point 5	1750 volts		

When the line voltage is 550 the alternating-current voltage obtained from the transformer on the last point of the resistance cut-out switch is 2905. As shown in the illustration, this transformer is mounted on a shelf directly over the small converter. On the shaft of the converter is a blower fan which exhausts directly up through the coils of the transformer, a box being provided about the transformer so that the maximum cooling effect may be obtained from the air circulation. While this air cooling is not necessary for regular testing work, it will be found very advisable to cool the transformer if current were to be passed through it for any long period of time unless the transformer is designed to withstand the temperature.

The transformer core is made of laminations cut from No. 26 gage stove iron clamped together by a through bolt at each of the four corners. There are two windings made up of No. 12 wire in the primary, 750 turns, and No. 21 wire in the secondary, 7050 turns; in all 100 lb. of wire were used. The secondary leads of the transformer, which carry a maximum voltage of 3000 from side to side, terminate in spring brass connection boxes enclosed in wood similar to those used for the heating buses connecting the cars of an elevated train, but other schemes are equally applicable.

This simple home-made converting and transforming set is made use of in the every-day work of the winding shop. Alternating current at various voltages is used for testing air-compressor motors, small electrical devices and the field coils and armatures of railway motors. All armatures that are repaired are given an insulation test with alternating current by connecting one lead to the shaft and the other to the commutator bars. In this testing work each piece under test is first subjected to a low voltage and if this is satisfactorily withstood the voltage is increased to a predetermined maximum by the simple method of regulating through the medium of resistance cut in and out of the primary circuit of the step-up transformer. Air-compressor coils are subjected to a test of 1470 volts as obtained when the control switch is on the fourth point.

The contactor magnets are rewound in the shop and field coils for railway motors are tested up to the same voltage as that for air-compressor motors. The mica-insulated armatures are ordinarily tested to 3000 volts. It is, of course, possible to convert a direct-current generator into a rotary converter by adding the requisite number of slip rings and making suitable taps to the armature or commutator. Any alternating-current voltage can be obtained then by means of a suitable transformer. A small two-pole generator may be caused to give alternating current by connecting a pair of insulated metal rings permanently to two commutator bars diametrically opposite each other. The frequency of the alternating current in cycles per second will be equal to the revolutions per second of the armature. For ordinary testing, frequency is not considered; but in the design of a transformer the frequency must be taken into account.

Milwaukee, Wis. John Hancock.

ENAMEL FOR RHEOSTATS.

The writer has sought for many years information on the constituents of the enamel used in rheostats in which the wire is embedded in the enamel, without avail. Recently, however, a friend has supplied me with some information on this point based upon some foreign rheostats, and feeling that perhaps many of your readers would like to obtain some information on this point the following is sent. In one rheostat, now displaced, two enamels of different melting points were employed.

The enamel which was used to hold the resistance wires to the base plate consisted of felspar, 52 parts; borax, 34 parts; china clay, 14 parts, and the enamel used for covering the wires consisted of 30 parts quartz, 20 parts borax, 34 parts stannic oxide, 9 parts carbonate of soda and 7 parts of potassium nitrate. The latter enamel has a lower melting point than the former. The securing enamel was either used in the form of a powder or in that of a paste made by fusing two-thirds of the felspar with the borax, grinding to a fine powder and mixing with water, adding the rest of the felspar, the china clay and two parts of magnesia carbonate. The process of manufacture consisted in applying a layer of securing enamel to a metal base plate, heating in a muffle furnace to a temperature of about 1300 deg. Fahr. to 1600 deg. Fahr., removing and, while still plastic, pressing the resistance wires into position. A layer of the second enamel was next applied and the whole again heated, this time to a lower temperature, just sufficient to fuse the second enamel while leaving the first sufficiently plastic to prevent the wires dropping through onto the base plate. This method was subsequently improved by bending the resistors in an insulating cement, consisting of equal parts of oxide of iron and lava mixed with a solution of silicate of sodium; the slab so formed being afterward coated on both surfaces with an enamel similar to those above. In the more modern methods of manufacture a cement drying with enamel-like surface is substituted for the separate cement and enamel. A rheostat of this type has the resistance proper in the form of a crimped metallic strip or ribbon made from an alloy containing 78 parts of copper, 18 parts of nickel, 3 parts of zinc and 1 part of ferromanganese.

The cement which is used consists of a mixture of 80 parts of fine clean sand or silica, 20 parts of silicate of magnesium, which is mixed with a sufficient quantity of silicate of soda solution to give the proper consistency. A layer of this paste is placed on the base plate and the crimped resistance wire placed in position, and more filling material applied to occupy the spaces between the crimps and to completely cover the resistors. The whole is then placed aside and allowed to harden, when it dries with a hard, smooth, stone-like surface. Another company has a rheostat made in a somewhat similar way.

The base is made from a compound containing 40 parts of asbestos, 38 parts of silica and 22 parts of calcium hydrate, which is compressed and placed in a closed chamber, where it is treated with steam under pressure (150 lb. per square inch) for about five hours. The resistance wires are placed in grooves either molded or cut in the base, and are covered either partly or entirely with a compound similar to that described above, but made liquid enough to flow around the wires and embed them, by omitting the fibrous material or grinding it to a fine powder. The rheostat is then again subjected to the steam treatment when the whole sets in a firm, compact mass. The melting point of either of the first two enamels can be lowered by adding a suitable quantity of metallic oxide, and it might be possible by this means to bring the enamel down so as to make it amenable to the action of a blowpipe.

New York. Joseph Boyd.

QUESTIONS AND ANSWERS

I have often come across the expression "singing arc" and would be pleased to have you inform me what it means. E. S. C.

Duddell discovered in 1900 that a direct-current arc between solid carbons gave a musical note of high pitch if a circuit containing inductance and a suitable capacity were shunted across the arc; hence the name.

Under what load factor do the best hydro-electric plants operate?

The combined output of the Niagara Falls Power Company and the Canadian Niagara Power Company is over 500,000,000 kw-hours per year and the load factor is over 70 per cent. This is the largest and most satisfactory hydro-electric development from all viewpoints that we know of.

What is the best type of fixture to use with tungsten lamps? G. P.

Tungsten lamps have been substituted for ordinary incandescent lamps in rigid fixtures through adapters, with good results. Since, however, the tungsten lamp is sensitive to vibrations, the best type of fixture for it would appear to be one with a chain stem instead of a pipe stem. The former would take up any vibrations and relieve the lamp. A rigid stem with a hook to which the tungsten lamp may be flexibly attached is also used.

The edge of one of the panels of a marble switchboard has been broken off, and we would like to know if it is possible to replace this piece without making the patch too noticeable. W. K.

The broken pieces may be joined by a cement composed of four parts of gypsum and one part of finely powdered gum arabic mixed to a mortar-like mass with a cold solution of borax. The object mended should not be disturbed for a few days and if necessary the cement may be given the color of the marble by adding the desired tint to the borax solution.

Why is it that in measuring the power on three-phase systems feeding motor loads that a single series transformer is used in connection with the instruments? V. H.

When the load on a three-phase system is made up entirely of motors, the load on the phases is generally considered as balanced, although it might be found that such loads are not truly balanced and that differences of current exist in the phases even when the pressure is uniform. In practice, however, one motor will more or less offset another by being affected in different phases and thus the tendency is to eliminate any unbalance.

Is there a convenient method of determining whether the loads are properly balanced on the two sides of a three-wire secondary network? J. H.

There is a series transformer on the market which is applicable for this purpose. The transformer can be carried by a lineman and placed around the secondary leads. By means of sufficient length of conductor, an assistant on the ground below can read from an ammeter the load in each leg. The transformer is wound on a two-piece ring so arranged that a small segment of the ring on which there is no winding acts as a hinge to be opened and closed over the conductor in which the current is to be measured.

In starting rotary converters which is the preferable method: by means of direct-current or from the alternating-current side? M. E. T.

It depends very much on the system which way a rotary converter is started, and also on the condition of the system at the time. When started from the direct-current side, a rotary may be synchronized and put on the line without any sign of disturbance; but in many cases direct-current starting has been abandoned for alternating-current starting on reduced voltage. When started from the alternating-current side, voltage disturbances result which, while not serious on railway circuits, are objectionable on lighting systems unless many converters are in service. The machine may be also run up above synchronous speed by means of a starting motor of the induction type, the motor switch being then opened and the converter thrown in as the speed falls past the point of synchronism.

Wherein does the split-pole converter differ from the ordinary rotary converter, and to what extent does the former machine excel the latter in practice? I. E. H.

The ratio of direct-current voltage to alternating-current voltage in a rotary converter is definitely fixed, so that in order to control the direct-current voltage in lighting stations, for instance, independent of the alternating-current voltage at the generating station, induction regulators, boosters, or dial switches for connecting taps in the transformer winding are required. In the split-pole converter these regulating devices are unnecessary, the machine having means of varying at will the ratio of the direct-current voltage to the alternating-current voltage, by the variation of field excitation. Machines of this type have only recently been placed on the market and the experience gained is too limited to make any just comparison.

What is usually regarded as the proper switchboard equipment; that is, how many instruments should an operator be obliged to watch in a fairly large station? D. L. N.

By some it is considered advantageous to have all the switches and instruments in a station under the operator's immediate reach and there may be cases where considerations other than mere show would call for such practice. Ordinarily, however, an operator should have before him only such instruments and such apparatus as are necessarily required in working the station. For instance, he should have before him such apparatus that every movement of the needle or other indicator means something to him. This not only insures simplicity but reliability as well. The actual instruments will depend on the station equipment, an alternating-current station requiring more instruments than a direct-current station.

How are lightning arresters usually grounded? O. S.

The best ground connection is probably that suggested by the underwriters. A 3-ft. x 6-ft. copper plate or larger of No. 16 Stubbs' gage is buried with 2 ft. of crushed coke or charcoal about pea size both under and above it. The ground wire is riveted to the plate in a number of places besides being soldered its entire length. A cast-iron plate with projecting forks which give large surface contact may possibly be better than the copper plate and the joint between the plate and wire should be thoroughly protected against corrosion by painting it with waterproof paint. In some cases the plate is kept wet by means of water pipe. Galvanized-iron pipe may be driven into the ground about 18 ft. or coils of copper wire may be placed in the bank of a river below water line, or if convenient the ground wire may be connected to steel flumes, steel structure or feed-water pipe. The ground wire has also been connected to the rails in the case of street railway systems.

We are operating an alternating-current system in a small city and recently have taken over a fair-sized factory which is now operated electrically by means of induction motors. By means of solicitors we have also connected up quite a few small motors to the system, and although we have 1000 kw of generating equipment in the station, we seem to have difficulty in carrying the load; the generators heating up before full load is reached. This is due to the motor load, because before this was augmented no trouble existed. Would a different type of motor change the conditions? H. K.

Where there are a large number of small consumers on a system and the majority of whom use induction motors because of their simplicity and operating characteristics, the power factor is usually quite low, especially if many motors are running light or only partially loaded. The result on the station equipment would be exactly as indicated—the alternators will heat up. Such a condition, unless remedied, would call for increased investment in generating and transmitting apparatus so that profits would be seriously impaired. By means of synchronous apparatus the power factor of the system can be made unity. It may be possible to get some customer to install a synchronous motor instead of an induction motor to drive his equipment and if necessary a lower rate for energy could be made as an inducement. The synchronous motor may be first brought up to speed and then the load gradually thrown on by means of a clutch. Synchronous motors require more care than induction motors, are not self-exciting and are started with some difficulty. A large excess of excitation is necessary in order to compensate for the lagging wattless current required by the induction motors.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Blackboard Map for Showing Service Main and Connection.

One of the problems confronting a central-station manager is that of providing some method for representing the service mains and connections in an ever-changing and increasing network of conductors. A neat solution of the problem has been devised and applied by Mr. P. F. Sellers for the Buffalo General Electric Company. One wall of the office of the chief electrician has been arranged as a blackboard, containing about 90 sq. ft., upon which has been painted in oil to a scale of 50 ft. to 1 in. a map of the business district of Buffalo. All conduit and service connections are shown on this map in yellow paint. The locations of manholes distinguished as to size are properly shown in blue paint. The alternating-current system of cables is painted in green, the direct-current, three-wire lighting circuits in red, and the 500-volt direct-current circuits in purple. The sizes of the individual feeder circuits are also indicated at the proper points.

This map is kept up to date with the minimum of difficulty, additions being made in the proper color and removals being painted over in black. The blackboard has proved excellent for representing at each instant the exact condition of the circuits of the rapidly growing network of the company.

"A Better, Bigger and Brighter Buffalo."

During the months of February and March the Buffalo General Electric Company addressed to its constituency a series of 30 "electric talks" through the advertising columns of the local daily papers. These have recently been reproduced in a neat and attractive pamphlet which not only enables a study of the series as a whole, but shows at a glance the direct and forcible nature of the appeal to the intelligence of the community, which is as much interested as the company is in seeing "a better, bigger and brighter Buffalo"—to use the alliterative phrase that is employed with good effect throughout the argument.

It is pointed out that while most of the customers of the corporation can move elsewhere if prospects are not favorable, the company in the very nature of things has to stay where it is and "face the music." Hence it has a keener interest than that of the ordinary citizen in the welfare and prosperity of the city served. Moreover, it is stated that out of the 332 stockholders, 306 are Buffalonians, of whom 161 are women. Twenty others are local estate holders. Only 26 live outside the city; and the pertinent remark is made: "We are loyal members of this community, large contributors to its support and are willing to shoulder our share of responsibility for its future." The distribution system of the company is equal to the wants of a Buffalo twice the size of the present.

As to the six stations of the company, it appears they have a capacity of 21,601 hp, 10 per cent of which is used only during 25 hours of the whole year and in one month of operation. One-half of the plant is used only one-half of the year, within seven months. The total output of all the plants in 1908 was 40 per cent of the entire capacity, but attention is called to the fact that it is all in a state of "readiness to serve" and that the storage battery capacity insures against interruption of the supply from Niagara. Moreover, it is noted that the energy from the falls is transmitted at great cost, and that exaggerated ideas prevail as to the "cheapness" of water-power. A comparison is made of the rates prevalent in Buffalo and elsewhere in 20 other cities, and in every instance Buffalo shows to advantage. The lighting rate ranges from 9 cents to 4 cents and the retail power rates range between 6 cents and 2 cents. On March 1, 1907, a five-year contract was entered into with the city, 2883 arc lamps being lighted at the rate of $56 per year, with underground circuit lamps at $75. The company made the reduction operative, on its own volition, from June 1, 1906, nine months earlier. As everybody knows, this is an unusually low rate for street lighting of 4000 hours. The series closes with an earnest and effective admonition to the readers "to help us boost Buffalo by spreading the truth regarding the city's electrical advantages."

Special Men and Specializing.

By H. H. MacPherson.

One of the chief attractions, and also one of the most important phases of new business work, is the consideration of the human element which enters so largely into every step which the company's representative takes with a prospective customer. There is probably no other place where this human element shows itself so plainly as in what is known in new business parlance as "big business." Consider, for instance, a business territory which has been in the hands of a good man who has been securing a large amount of big business as well as a goodly amount of smaller business. Put a comparatively new man in this same territory and within a month the revenue of that territory decreases enormously, simply because the personal element is lacking between the representative and the prospective customer. During the second month the representative busies himself in re-establishing this natural human relation, and soon the big business begins to come in larger than ever before, after the personal relation has again been established.

The business world as at present constituted divides itself into two great classes—those persons whom a business man knows personally, and those whom he does not know. Other things being equal, the man who is known personally is the man who gets what he goes after.

The problem of knowing what to go after and how to go after it is the largest part of a representative's work. In these respects his business and residence districts are very different. In the residence district business runs along certain well-defined grooves with now and then a striking addition—such as the electric iron. In the business territory the grooves are there, but they are constantly changing and the special cases are in the large majority. Here then arises the need of specializing.

Those merchants who are using sign, outline and window lamps upon the dusk-to-midnight flat-rate contracts at this time of the year are getting some splendid advertising due to the very large number of people who are always downtown until 5:30 or 6 p. m. During the months of early dusk many people who go home at 5:30 or 6 p. m. throughout the year see this lighting who do not see it at any other season of the year. Therefore it seems that this is the best possible time to make contracts for a large number of flat-rate signs, windows and outlines. It is well to specialize on the classes of business throughout the coming month. Probably each representative has a number of good prospective customers in each of these lines to which he is attending in connection with his other work. Or possibly he may have been so busy along other lines that he has neglected future flat-rate customers. In either case there is no question that if a little closer attention be given to this special class of business big results in increased revenue will follow.

A prominent new-business man once said: "I have noticed that no matter how hard you may be working along any par-

ticular line or along all lines, when I ask you to specialize along any one line the immediate results shown in increased revenue in that line are very surprising."

In the same way seasonal variations to a greater or less extent govern the introduction of appliances. During the warm months ranges, water heaters and electric irons are easily sold. In the winter months even more energy is expended in keeping them in commission and in selling heaters. The long lighting hours also make the solicitation of wiring good revenue-bringing business.

Many of the smaller companies consider that specializing is proper for the large companies, but would never do for them. In reality there is more need for periodical effort along particular lines in the small company with a few men than there is in the large company, because the more varied the duties which any one man has the more liable he is to fall into a rut and neglect all of the classes of business which do not have a special interest for him. It refreshes a man and gives him new life in all of his work to take up some neglected phase and find that it will result in a big success when his efforts are properly directed.

A certain man who eventually became one of the best new-business getters in his company was almost completely discouraged at the end of his first month in the commercial department. He had failed in his efforts at closing big business and was about to give up in despair. Like many novices in commercial work he had looked upon electric irons as too small a revenue producer to bother with. However, he finally decided to see what could be done with them. His record caused him to regain his lost confidence, and he became one of the best men in the business, simply because he found this neglected part of his work could be made a success.

Although varying conditions may make it necessary to specialize along certain lines at certain times, it is essential that the representative should plan his work so that he will carry on a campaign along all lines even though he is specializing for a short time on one or two. Having the men specialized on different lines every little while serves to teach them that there is good business to be had in every direction, and therefore all lines should be worked continuously. That is one of the hardest lessons which a new man has to learn. If he starts a campaign upon signs and motors, and is successful, it is natural that he should work these lines to the detriment of others. That fact explains why the same territory may have a wonderful reputation one year for signs and the year later for interior lighting.

There are certain classes of business, such as motors, signs, outlines and interior business lighting, which are of the utmost importance to an electric company on account of the large net revenue which they are sure to bring in. The motor load fills up the valleys in the daily load curve and plays a large part in keeping out isolated plants; signs, outlines and windows when lighted from dusk to midnight or on all-night flat rates are one of the most profitable loads which a central station can have, besides being of immense value in an advertising way.

The above are some of the reasons why almost every central-station company finds it a good policy to have special men—men who specialize along these lines. Not every company is large enough to have men who devote their entire time to specialties, but certain representatives are detailed to, say, a small district where they spend a part of their time assisting the other representatives in the capacity of special men.

It is coming to be recognized that the general effect of any special man's work is quite often as productive of good results as the special effect. In other words, the special man's position and work as the executive head of his department in directing the representatives how best to secure business in his line, and in keeping them keyed to the proper pitch, is getting to be a much larger part of his real value to his company than is his original duty as an advisory engineer.

For instance, "special men's morning" in one large company brought out a chart on which was shown the flat-rate revenue secured in each district during a certain month a year previous. At the top of this chart in red letters was the question: "Mr. Representative, in March, 1908, your territory turned in flat-rate contracts and revenue as shown below. How about March, 1909?" It is needless to say that March, 1909, beat March, 1908. A new motor man was brought into a company where it had always been considered a breach of etiquette for a special man to go anywhere except when asked to do so by a representative. The special man was also supposed to allow the representative to report all the business secured in his territory even though some of it thus failed to be reported. This new man at once started in to make a thorough canvass of each territory. During the first two months he himself closed more motor contracts than had the whole department during the entire previous year. Then the representatives themselves got busy and the increased revenue from motor business was astonishing.

When the tungsten lamp first came on the market in a practical form the electric company in a certain city was having a great deal of trouble with a gasoline-plant epidemic. No less than 50 plants had been installed in about 15 months. This company looked with alarm on the incoming tungsten lamps, foreseeing nothing but a still further decrease in revenue. In order to postpone the decrease as long as possible it began to sell the lamps at cost and also delegated one of its representatives to make a study of the conditions in the various territories and see what could be done. As a direct result of the plan which he originated the months following his appointment showed the largest increased revenue in years in the very lines which were expected to show the decrease. In addition the number of gasoline plants decreased from 50 to 30.

By such examples as these it is clearly evident that the special man has come to stay. His work is daily becoming more varied and important. His ability as an executive will soon be the most important factor in his work; at least in the larger companies this fact is being most effectively remembered in the training of men for this work.

Improvements in the Rockford (Ill.) Central-Station Plant.

The Rockford Electric Company, which is one of the properties controlled by the American Gas & Electric Company, supplies all of the energy for lighting and for traction on the city and interurban railroads centering in Rockford. For a number of years the central-station service was entirely 110-volt and 220-volt direct current. Some 550-volt direct current was also generated for supplying energy to the city railway lines and rotary converters, and step-up transformers were installed for delivering 13,200-volt, three-phase energy to transmission lines for interurban railway purposes. As the central-station distribution had reached out to cover a very large territory for a direct-current system, alternating-current distribution was installed during 1907 for supplying energy to the outlying districts.

The company also acquired a local corporation known as the Central Heating & Power Company, which operated a plant near the downtown district for commercial lighting and heating. This plant is still operated during the heating season. A third plant controlled by the company is that at Beloit, which was built by the Rockford, Beloit & Janesville Interurban Railway. This railway was purchased by the interests controlling the Rockford city lines and the other interurban roads centering in Rockford. These latter, always having purchased energy from the central-station company, desired to continue this policy rather than bother with the acquired power plant at Beloit, and therefore the Beloit plant was leased to the Rockford Electric Company and is operated by it in carrying out the contract to supply energy to the railway companies.

The power-plant situation at Rockford is of engineering interest chiefly because of the great variety of equipment and prime movers which are employed in supplying different kinds of energy and in the methods of interconnection between the different classes of customers.

The original main plant was largely a water-power equipment.

The water-power was gradually outgrown, however, so that now the steam equipment is far greater than the water equipment, although the water-power is applied to as large a proportion of the output as possible. The main plant now has a 600-kw equipment connected to eight new 210-hp waterwheels. This set of waterwheels drives a lineshaft operating 600 kw in 140-volt direct-current generators. There is also another lineshaft from which are operated seven 6.6-amp, 125-lamp Brush arc

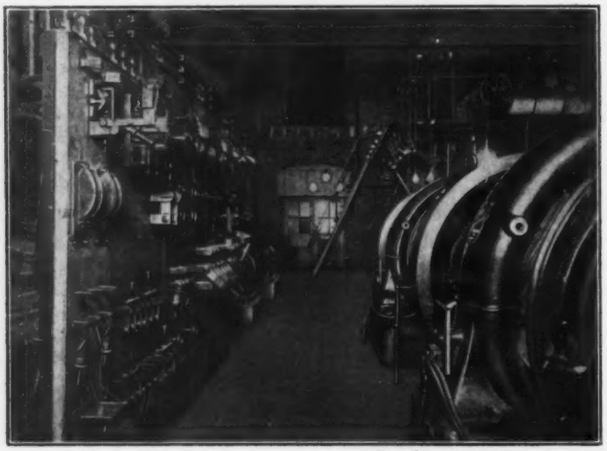


FIG. 1.—INTERIOR OF CENTRAL PLANT.

machines. A new concrete wheel house has just been built. This plant contains a 4100-kw equipment in steam-driven generators. Of this 1000 kw is in the shape of two 500-kw Curtis turbo-alternators, giving three-phase, 60-cycle, 2300-volt energy. The turbines are provided with barometric condensers. The energy from these generators is used for a four-wire, three-phase distributing system giving 2300 volts between the neutral and the lead wires, and 4000 volts between the lead wires. There are a number of compound condensing engines, directly connected to 550-volt railway generators and also some condensing engines for direct-current, 110/220-volt service. At the central heating plant there is a 600-kw equipment consisting of two direct-connected high-speed simple and one compound steam engines. At the Beloit railway plant there is a 1080-kw equipment in three-phase, 25-cycle generators, supplying energy to 13,200-volt transmission lines and rotary converters. Since the American Gas & Electric Company took hold of the property in May, 1907, no generating equipment has been added, but

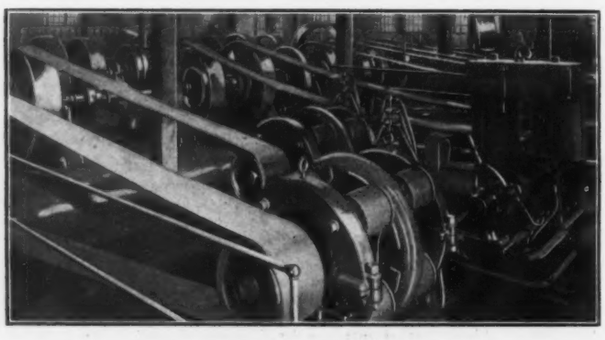


FIG. 2.—GENERATORS OF MAIN PLANT.

machinery has been installed at the main plant which adds considerably to the flexibility of the system, by making it possible to use turbines or engines driving generators for one kind of service to deliver energy to other classes of service. There has been installed one 500-kw motor-generator set, which consists of a 60-cycle synchronous motor, directly connected to two 250-kw, 250-volt, direct-current generators. These generators can either be run in parallel to feed energy into the direct-current lighting network or they can be connected in series to feed energy into the railway busbars at 500 volts. If the conditions are reversed, the railway or direct-current lighting system can feed energy into the 60-cycle system. Another motor-generator set which has been installed consists of a 300-kw, 60-cycle synchronous motor, directly connected to a 25-cycle, 550-volt rotary converter. With this the 60-cycle system can supply 550-volt, direct-current energy to the railway or 25-cycle, alternating-current energy suitable for transmission purposes for the railway. If the 60-cycle system is in need of energy, this process can be reversed. The main plant has excellent coaling facilities, as the sidings of two railroads run to the plant. For the central plant coal must be hauled. The engine- and boiler-room floor in the central plant is below the sidewalk level, as the street at this point is a bridge approach. The boiler-room is under the front part of the building, and coal is unloaded from the street directly in front of the boilers.

The central plant is operated at full load continuously during the heating season, in order to supply exhaust steam for heating. As an adjunct to the large main station it can be operated much more to advantage than as a separate isolated plant running throughout the year with high generating costs during the summer. The interior of the central plant is shown in Fig. 1. Two interior views in the main plant are shown in Figs. 2 and 3. From Fig. 2 it will be seen that there is plenty of the older types of apparatus in part of the main plant. This equipment is gradually being displaced by larger units, as far as the direct-

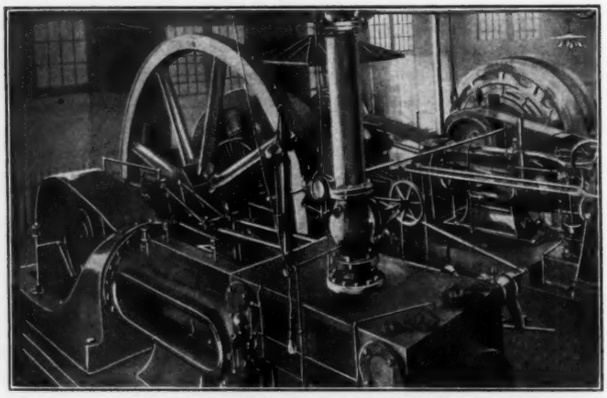


FIG. 3.—ENGINE EQUIPMENT OF MAIN PLANT.

current system is concerned. Some of the Edison bi-polar machines which have been running many years without trouble, although small in size, serve well as balancers on the three-wire system, as the newer generators are wound for 250 volts.

Some very fine work has been done in the building of distributing lines through the outlying districts. When the alternating-current system was installed the size of the direct-current distributing system was very much reduced and everything but the downtown district was supplied with alternating-current energy. Some of the large factory motor users which the company has secured as consumers justify special feeders. All of the new lines have been placed on Idaho cedar poles, from 40 ft. to 65 ft. high. The 13,200-volt railway transmission lines are placed on the top cross-arms, and the 2300-volt and 4000-volt, three-phase, four-wire feeders on the lower cross-arms. In many cases the wires of the telephone company occupy a still lower cross-arm.

Plans and specifications are now being prepared which contemplate the installation of 3000 additional boiler horse-power and two 200-ft. stacks at the main plant with 4000-kw additional steam-generating equipment, the installation of a coal-handling system with bins, of a new fireproof roof for the engine-room and two electric traveling cranes.

Moreover, it is proposed to extend the steam-heating mains from the heating plant to the main plant, a distance of 2500 ft. The object of the proposed improvements is to generate all energy at the main plant and discontinue the heating and Beloit plants, except for emergency reserve.

INTERIOR WIRING, AND ILLUMINATION

Street and Sign Lighting in Joliet, Ill.

The Economy Light & Power Company, of Joliet, Ill., has worked out an interesting system of ornamental street lighting in the business district of Joliet. The problem was to meet a demand for improved street lighting along streets where there are electric railway lines. To install the stereotyped style of boulevard lights would have necessitated the erection of ornamental poles alongside steel trolley poles for supporting overhead trolley wires, and it was to avoid this condition that the combination pole illustrated herewith was devised.

FIG. 1.—COMBINATION POLE.

After many experiments it was found there was not sufficient strength in a cast-iron pole to permit of a trolley attachment, and that a steel pole would not permit of sufficient ornamentation. The idea of two separate and distinct poles in one was then taken up. A standard 28-in. steel trolley pole with 7-in., 6-in. and 5-in. sections is used, weighing 632 lb. This serves as a core, and in order to obtain an artistic effect it is surrounded with an ornamental casing, as shown.

The center of the lights suspended from the four arms is 12.5 ft. from the sidewalk. The elevation and distance between the center of the lights were obtained after actual experiments and after consultation with an illuminating engineering authority. A favorable opinion was received from the Commercial Club, the Merchants' Association and the Art Study Club of the city, as to the design, so that there is harmony among all the interests working for a more beautiful city.

FIG. 2.—BUILDING-OUTLINE LIGHTING IN JOLIET.

Property holders pay for the ornamental street lighting thus furnished, on a two years' contract, at $1.25 per front foot, per year, divided into 24 monthly instalments.

The poles are spaced 70 ft. to 75 ft. apart and each carry four 60-watt tungsten multiple lamps, which burn from dusk until 11 o'clock, except the lamps on the diagonal corners of street intersections, which burn all night. The latter displace the city arcs at that point, the city paying for this service the price it paid for the overhanging arcs.

In the section in which this street lighting is carried out all of the service is taken into the alleys, the streets being cleared of all wires except those carrying the service for the ornamental lighting. The American Railways Company owns the street-railway system and willingly co-operated in the work, having furnished and erected the steel trolley poles, thus making the only expense to the lighting company that for the ornamental cast-iron exterior and its erection.

About two years ago the Economy company put up the first electric sign in Joliet, in front of its office, reading "Electric Light and Power." It now supplies 69 signs, producing a revenue of $8,874 per year. At present the building of the company is outlined with light, as shown in the accompanying illustration.

This company serves 50,000 people in the cities of Joliet, Lemont, Plainfield, Rockdale and New Lenox. It has a connected load of 191,014 16-cp equivalents, with annual earnings of upward of $310,000. Mr. Charles A. Munroe is manager of the plant of the Economy company.

A Pendant Fixture for Experimental Installations.

BY ARTHUR GILLMAN.

In replanning the illumination of certain departments of an industrial corporation some doubt arose as to what particular arrangement of single lamp lighting units would be most efficient. All of the rooms to be lighted were of practically the same dimensions and had the same general color characteristics. Each had been illuminated by one four-mantle gas lamp centrally located. suspended from the ceiling. Tungsten lamps easily proved the most economical type of illuminant and general illumination seemed desirable; but there was a reasonable question, inasmuch as the work carried on in the rooms was of an unusual nature, whether it would be best, for lighting each room, to install a few high candle-power tungsten lamps or several of low candle-power; the energy consumed per room to be approximately the same in each case.

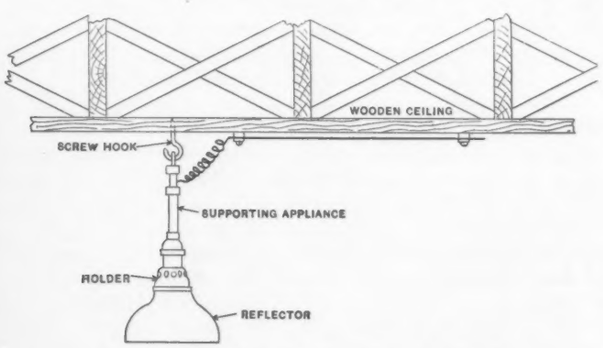


FIG. 1.—APPLICATION OF PENDANT FIXTURE.

Low cost of wiring and fixtures would favor the few high candle-power lamp method, while a more uniform distribution of light and less decided shadows would be obtained by the other method. The problem was so subtle that it was decided to make a series of tests to determine which arrangement was best suited to the conditions. Accordingly, in a typical room detailed for the purpose, several different arrangements of units were tried out. It is the purpose of this article to de-

scribe the makeshift fixture, assembled from stock components by the company's electrician, for use in the trials.

Fig. 1 shows the application of the device and Fig. 2 its details. Obviously, for a very temporary installation, it would be entirely feasible to support a tungsten lamp, shade holder and shade by two wires made up on the socket terminals; but as the trial under description was to extend over quite a period it was deemed best to provide the substantial arrangement shown. The wrought-iron pipe nipples (Fig. 2) were about 8

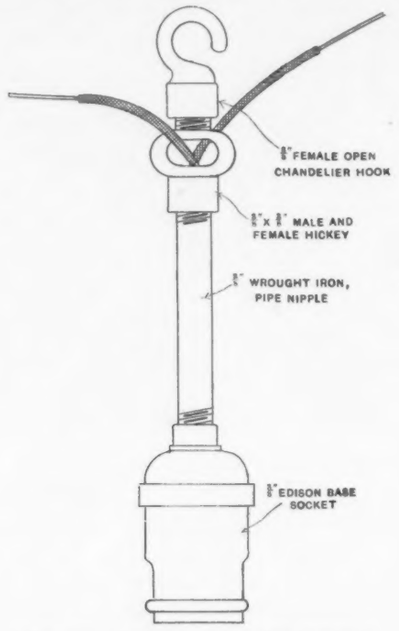


FIG. 2.—DETAILS OF PENDANT FIXTURE.

in. long and threaded at each end with a 3/8-in. standard pipe thread. At one end the keyless socket was twisted on and at the other the malleable-iron "hickey" and the chandelier loop. No. 18 fixture wire was used to convey electricity from the branch wires, cleated to the ceiling, to the socket. Each appliance was wired complete in the electrical shop.

In the wooden ceiling of the room, in which the test was to be made, screw hooks were inserted where there was any probability of desiring to hang an experimental lighting unit. These screw hooks were of small diameter, about 3/32 in., and were all placed prior to the beginning of the experiments. To test the effect of different arrangements of units it was only necessary to hang one of the appliances, shown in Fig. 2, on each of the designated screw hooks (see Fig. 1 showing complete unit in position), insert in the sockets lamps of the desired candle-power and fit the appliance with the proper reflector. Electrical connection between fixture and branch wires was effected through hand-twisted, unsoldered, taped joints, the ends of the fixture wires having purposely been left bare.

In mills and factories, where appearance is not a great factor, fixtures of the described type should be entirely satisfactory for permanent work.

Elementary Illumination Calculations.

By N. Whitney.

Two things are essential to any engineer—and an "illuminating engineer" is no exception—"common sense," which needs no comment, and "judgment," which is largely a matter of experience. One of the things which will greatly assist judgment and render decision easier is keeping all authentic data, and all other data, noting their reliability. This means that when an illumination curve has been worked out, for instance, the data from which it was computed should be filed in a systematic way, so that it will never again be necessary to devote time and brains to ascertain the results arising from similar conditions.

In this article will be explained methods which experience has shown to be correct for solving problems in illumination. It will be assumed that the reader has no particular knowledge of illuminating engineering, but that he understands simple draughting and how to use logarithms and a slide rule. A knowledge of elementary trigonometry is useful, but not essential. The terms and expressions used are those generally employed, no attempt being made to dispute or justify their correctness.

Aside from purely mechanical or electrical problems, the illuminating engineer deals with three units. These are the candle-power, or unit of intensity of the light source; the foot-candle, which is the illumination produced by a source of 1 cp at a distance of 1 ft.; the lumen, or quantity of light required to produce an illumination of 1 ft.-candle over an area of 1 sq. ft. Since a sphere of 1 ft. radius has a superficial area of 4π ($=12.57$) sq. ft., it follows that 1 spherical cap—that is, 1 cp in every direction—gives 12.57 lumens.

Two laws govern all the practical problems in illuminating engineering; namely, the intensity of illumination varies inversely as the square of the distance from the source; the intensity of illumination on any plant is proportional to the cosine of the angle at which it meets a perpendicular to that plane.

One of the greatest, if not the greatest, single aid to the illuminating engineer is a polar candle-power curve of the light source which may be under consideration and its accessories. Several of the manufacturers of lamps and reflectors advertise their willingness to supply such curves free to responsible parties, and anyone contemplating taking up illuminating work should equip himself with as many as possible.

The illuminating calculator, patented by Mr. Norman Macbeth, is a device of great assistance to the illuminating engineer as it gives graphically, in a way somewhat similar to a slide rule, results otherwise requiring long calculations, even using logarithms, in a fraction of the time. For the present it will be assumed that the reader is not equipped with one of these calculators.

Polar paper, devised by Mr. A. A. Wohlauer, having in addition a set of lines for measuring the quantity of light—in lumens—may now be purchased, and may advantageously be used for measuring the mean upper, mean lower and mean spherical candle-power without resort to the Rousseau diagram. To find the total lumens of any unit by means of this paper, plot

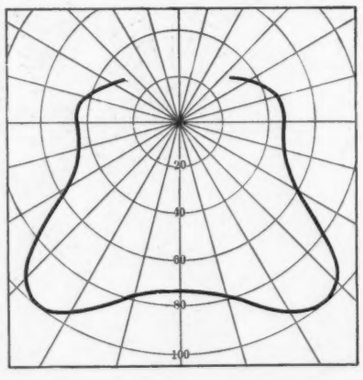


FIG. 1.—ILLUMINATION CURVES.

on it the polar candle-power curve of the unit, and at the points where the dotted radial lines intersect, in either quadrant 0°—90° or 90°—180°, add together and divide by 10. This will give the mean lower hemispherical candle-power (*m.l.h.s.c.p*) and mean upper hemispherical candle-power (*m.u.h.s.c.p*), respectively, usually written $J_{\smile}$ and $J_{\frown}$, adding these together and dividing by 2 gives the mean spherical candle-power (*m.s.c.p*) or J_o.

The lumens in the lower and upper hemispheres are given by

the equations $J_{\smile} \times 2\pi =$ lumens and $J_{\frown} \times 2\pi =$ lumens. The sum of these two equals the total lumens, or total lumens $= J_o \times 4\pi$.

After securing polar candle-power curves as mentioned, the next step is to compute a table of the angles of various heights (H) and distance (D) ordinarily used. This table is shown (Table I) with angles to nearest quarter degree only, as it is usually impossible and quite unnecessary to read a polar curve any more closely. The heights and distances are given from a point directly under the unit, from 6 ft. to 9 ft. height and 0 ft. to 24 ft. distance.

TABLE I.—ANGLES.

Distances in feet.

Height in feet.	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	22	24
6...	9° 30′	18° 30′	26° 30′	33° 45′	39° 45′	45° 0′	49° 30′	53° 0′	56° 15′	59° 0′	63° 30′	66° 45′	59° 30′	71° 30′	73° 15′	74° 45′	76° 0′
7...	8° 15′	16° 0′	23° 15′	29° 45′	35° 30′	40° 45′	45° 0′	48° 45′	52° 15′	55° 0′	59° 45′	63° 30′	66° 30′	68° 45′	70° 45′	72° 15′	73° 45′
8...	7° 15′	14° 0′	20° 30′	26° 30′	32° 0′	36° 45′	41° 15′	45° 0′	48° 30′	51° 15′	56° 15′	60° 15′	63° 30′	66° 0′	68° 15′	70° 0′	71° 30′
9...	6° 15′	12° 30′	18° 30′	24° 0′	29° 0′	33° 45′	38° 0′	41° 45′	45° 0′	48° 0′	53° 0′	57° 15′	60° 30′	63° 30′	65° 45′	67° 45′	69° 30′

Table II shows the cube of the cosine ($\cos^3 \alpha$) of the angles in Table I. The preparation of such a table is laborious, but a very few computations without it would mean more work than preparing the table. There should be provided also a celluloid protractor having 15 deg. and 5 deg. lines extending to within ⅜ in. of the origin. The protractor need cover only one quadrant, as most curves are symmetrical in both the upper and lower hemispheres, and the upper hemisphere may be treated in a manner similar to the lower.

TABLE II.—CUBE OF COSINE OF ANGLES IN TABLE I.

Distances in feet.

Height in feet.	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	22	24
6.....	.9594	.8529	.7167	.5748	.4545	.3536	.2739	.2180	.1715	.1366	.0888	.0615	.0429	.0320	.0239	.0182	.0142
7.....	.9693	.8882	.7756	.6544	.5396	.4348	.3546	.2866	.2295	.1887	.1279	.0888	.0631	.0476	.0358	.0283	.0219
8.....	.9762	.9135	.8218	.7167	.6099	.5144	.4250	.3536	.2909	.2452	.1715	.1222	.0888	.0673	.0509	.0400	.0320
9.....	.9823	.9306	.8529	.7624	.6691	.5745	.4893	.4153	.3536	.2996	.2180	.1616	.1194	.0888	.0693	.0543	.0429

METHODS.

The normal illumination in foot-candles at any point is equal to the candle-power of the light source in that direction J, divided by the distance (d) squared (in feet) from the source to that point, or

$$J_n = \frac{I}{d^2} \qquad (1)$$

The horizontal illumination at any point on a horizontal plane is equal to the candle-power of the light source in that direction divided by the distance squared (in feet) and multiplied by the cosine of the angle which the ray of light makes with a normal to the plane, or

$$J_h = \frac{J \cos \alpha}{d^2} \qquad (2)$$

These formulas reduce to a more useful form as,

$$J_n = \frac{J \cos^2 \alpha}{H^2} \qquad (3)$$

$$J_h = \frac{J \cos^3 \alpha}{H^2} \qquad (4)$$

in which, for any given height at which the unit is placed, the denominator is a constant, and the $\cos^3 \alpha$ may be taken from Table II, leaving only the candle-power, which, of course, must vary according to the lamp and reflector used.

Assume now a set of conditions and work out the complete results. Take $H = 9$ ft., and use the accompanying curve.

Consulting Table I it is noted that for $H = 9$ and $D = 1$ the angle is 6° 15′, of course, being 0° at $D = 0$. Laying the protractor on the curve at 6° 15′ the value is found to be 73 cp. At $D = 2$ the angle is 12° 30′ and the candle-power 76. In like manner the other intensities are shown in Table III.

For a large light source, hung at a height exceeding 15 ft., it would be well to carry the illumination calculation further than 24 ft.

Using an ordinary slide rule, set the slider at the height in feet, at which the light source is placed, on the lower or D scale and bring the corresponding value of I (from the above table) on the upper edge of the slide, under the hairline of the slider. Now, opposite the value of $\cos^3 \alpha$ (from Table II corresponding to the height and distance) on the upper (A) scale, read the value of the horizontal illumination in foot-candles. For example, at $D = 2$ in the chosen case the angle is 12° 30′ and $\cos^3 \alpha$ is 0.9306, also $I = 76$. Using formula (4)

$$J_h = \frac{76 \times 0.9306}{81} = 0.874.$$

The values are given in Table IV for $D = 0$ to $D = 24$.

One can now proceed to a determination of the illumination on a horizontal plane. The average condition is that the plane requiring illumination is from 2.5 ft. to 3 ft. above the floor, and since 9 ft. has been selected for H, the height of the source of light will be from 11.5 ft. to 12 ft. above the floor, well out of the direct line of vision.

The selection of the proper distance apart for the sources in lighting an area is one requiring experience and judgment, but the expert can place them correctly almost at the first trial. In the case chosen the results obtained with units 12 ft. apart and an area of 144 sq. ft. per unit (Fig. 2) are as shown in Table V.

TABLE III.

Distance.	Candle-power.	Distance.	Candle-power.	Distance.	Candle-power.
0	72.0	6	97.0	14	68.0
1	73.0	7	99.5	16	59.5
2	76.0	8	99.0	18	55.0
3	81.0	9	96.5	20	52.5
4	86.0	10	90.5	22	50.0
5	93.0	12	78.0	24	48.5

At point A, for instance, there will be the illumination from one unit at 0 ft., three units at 12 ft. distance, and two at 17 ft. distance. Adding the value of I_h as found from the first computations $0.890 + 3\,(0.210) + 2(0.074) = 1.668$ ft.-candles is the total horizontal illumination. At point H the illumination would be that from one unit at 2 ft., one unit at 10 ft., two units at 12 ft. and two units at 16 ft., the corresponding values of I_h being $873 + 0.335 + 2\,(0.21) + 2\,(0.088) = 1.804$ ft.-candles.

TABLE IV.

D	J_h	D	J_h	D	J_h
0	.890	6	.691	14	.136
1	.886	7	.601	16	.088
2	.874	8	.508	18	.060
3	.853	9	.422	20	.045
4	.809	10	.335	22	.034
5	.768	12	.210	24	.026

TABLE V.

A = 1.668	F = 1.540	J = 2.000
B = 1.699	G = 1.427	K = 1.990
C = 1.750	H = 1.804	L = 2.020
D = 1.884	I = 1.953	M = 1.794
E = 1.692		

These distances may be measured on a scale drawing with sufficient accuracy, and values may be taken from the table by interpolation. Similarly at points B, C, D, E, F, G, H, I, J, K, L and M the results in foot-candles are as in Table V.

For the novice it is advisable to plot these values in a curve, thus showing graphically the "hills and valleys." Experience will soon enable one to judge of the distribution of light by merely noting the computed values in their proper place on the plan. This should be done in any case for reference when similar conditions are encountered.

Practice shows, and one engineer who checked up with an illuminometer (or portable photometer) has stated, that a 33 per cent variation in illumination cannot be detected by the naked eye. It is also true that for most work, such as stores,

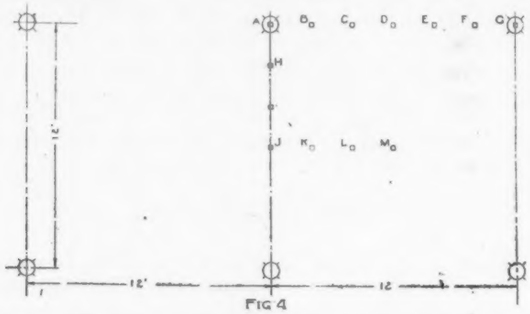


FIG. 2.—DISTRIBUTION OF LAMPS FOR EFFECTIVE ILLUMINATION.

churches, etc., 40 per cent, or even 50 per cent, variation, while detectable, is not objectionable. However, 30 per cent is a much better figure, and should always be attained if structural difficulties are not encountered. In Table V it will be noted that the minimum illumination is 1.427 and the maximum is 2.020, so that the former is 70.6 per cent of the latter. Reflection from ceiling and walls, which need not be calculated practically, can be depended on to increase the illumination and add to the uniformity.

If a higher intensity is desired, of course, two, three, four or more lamps may be used as a group-source without materially altering the light distribution, although more than four lamps to a fixture are seldom used on account of the rather heavy appearance.

Letter to the Editors.

Ornamental Street Lighting.

To the Editors of Electrical World:

Sirs:—It is refreshing to note in connection with Mr. Sawyer's article on "Ornamental Street Lighting at Des Moines, Ia.," which appeared in the first issue in May, that the tendency is toward permanency and effectiveness as indicated in artistic standards and posts, and away from the flimsy and inefficient as exemplified in festoons and arches over the roadway. To the musical ear dissonance can be no more vexatious than is the lack of taste displayed in some forms of public lighting, to a person with even a very ordinary sense of the appropriate. Why anyone should light the middle of a roadway where none but horses travel is beyond comprehension; the more so since at night the roadway is deserted even by horses. True, such a scheme possesses some spectacular merit, but not of lasting quality. With the advent of the more efficient and high candle-power incandescent lamps, the adaptability of the shorter lamp-post and standard for street lighting was appreciated as never before, but here, in some cases, the tendency is toward the other extreme. A metal post lends itself to very artistic treatment, and artistic treatment to many is synonymous with classical. Lighting standards should, however, be useful as well as ornamental, and from the very nature of things it would appear that light should not be sacrificed for beauty.

To the writer there are abundant opportunities for compromises in post designs. Some of the heavy lanterns in use are architecturally perfect, but they are about as serviceable for illuminating purposes as are the eyes of a gargoyle. In many cities fluted posts with ornate capitals smaller in diameter than the outer globe of the lamp fixture are used with satisfaction, and where more than one lamp is used, a type of post like that used in Des Moines and in many other cities is pleasing architecturally and gives good illumination as well. But any column on a sidewalk is preferable to festoons of lamps over the roadway.

St. Louis, Mo. Frederick Baylis.

Digest of Current Electrical Literature

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Compounding Alternators by Means of a Condenser.—W. Linke.—An illustrated description of a method of compounding single-phase and polyphase alternators, which has been tried by Eichberg for alternators of small output. For larger machines the high price of the condensers is prohibitive. On the other hand, the method is exceedingly simple and there is no lagging of the change of the voltage at the terminals behind the change of load. Fig. 1 shows the arrangement. In order to reduce the size of the condenser, it is connected to the secondary

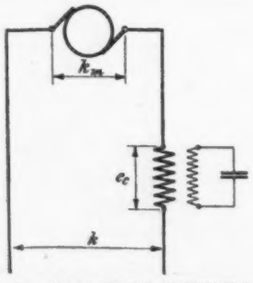


FIG. 1.—DIAGRAM OF CONNECTIONS.

of a transformer, the primary of which is in the main circuit. The ratio of transformation is so chosen that for the maximum current the voltage of the condenser is not above the maximum value permitted by the insulation. The compounding action is explained by means of vector diagrams and the results are given of tests made with an 8-kilovolt-ampere machine. The condenser consisted of 20 Leyden jars with a capacity of 0.2 microfarad. The transformer had a rating of 6 kilovolt-amperes and had an adjustable ratio of transformation. The compounding action follows instantaneously any change of current. Perfect compounding is obtained, however, only with constant power factor and for railways and power transmission the results are entirely satisfactory. In order to reduce the price of the condenser, it is preferable to use as high a voltage as possible. The condenser must be protected against excessive voltages (short circuits in the network). For this purpose the saturation of the transformer may be so chosen that it operates at normal current in the knee of the saturation curve, or horn lightning arresters may be employed, which short-circuit the condenser.—*Elek. Zeit.*, May 13.

Alternating-Current Generators.—Lyle.—An abstract of a (British) Physical Society paper. The author points out that the theory of armature reaction as ordinarily discussed by electricians is unsatisfactory, as an important effect due to the mutual induction between the current in the field winding and the current in the armature circuit is neglected. To simplify the problem, the case of a simple ironless single-phase alternator is first discussed. The magnetic field, supposedly uniform, is due to the current in a fixed coil of wire connected with a

source of constant e.m.f., and the armature is composed of a coil of wire rotated in this field with constant angular velocity. Under these circumstances the mutual inductance between the two circuits may be supposed to vary in accordance with the harmonic law. The differential equations which determine the values of the two currents are easily written down, but their solution presents difficulty. The author gives a method of getting the complete solution. He first assumes that both the currents can be expanded in Fourier series. He then applies a novel vector method and obtains equations to determine the value of the harmonic of any order in terms of the constant term in the field current. The operators in these equations are infinite determinants; but he shows how these can be readily reduced to continued fractions. In practice, the resistance of the exciting circuit is small, compared with its inductance, and thus the time constant is large. The continued fraction operators therefore rapidly become recurring, and so the equations giving the solution are simple. The results prove that only odd harmonics appear in the expression for the armature current, and only even harmonics appear in the expression for the field current. The frequency of the induced ripple superposed on the exciting current is therefore double the fundamental frequency. The interesting fact is proved that this ripple is assymmetric—that is, the positive half of the wave is of a different shape from the negative half. A simple geometrical solution is also given. The author next takes into account the effects of hysteresis and eddy currents. This he does by means of the permeability operators, the use of which he has formerly explained. The magnetic leakage of the armature is also taken into account. As a practical illustration of the method, the operation of a small two-pole alternator when supplying a non-inductive load is predetermined. A diagram is given showing the exact shape of the current wave in the armature, the ripple superposed on the exciting current and their relative phase displacement. The action of the "dampers" and the theory of the synchronous motor are also discussed. The complete paper on this subject has not yet been published.—Lond. *Electrician*, May 14.

Motor-Converters.—An account of the discussion which followed the recent paper of Hallo on "motor-converters" or cascade converters. E. Rosenberg remarked that a wide range of voltage could be obtained on the direct-current side of a rotary converter without the use of a booster by employing tappings on the transformer, and that nowadays a direct-current machine corresponding to a frequency of 50 cycles per second was by no means a dangerous thing. B. M. Jenkin commented on the satisfactory results which had been obtained with motor converters in the Great Western Railway substations, mentioning in particular the high over-all efficiency. A. H. Seabrook and J. S. Peck spoke in favor of the rotary converter, claiming higher efficiency and greater reliability. K. Faye Hensen thought that the high resistance claimed for the motor-converters is obtained quite easily for rotary-converters by means of a suitable design of transformers.—Lond. *Elec. Eng'ing*, May 13.

Induction Motors.—S. P. SMITH.—The conclusion of his long mathematical paper illustrated by diagrams, on the application of the no-load and short-circuit diagram to the design of induction motors, and a new application of the exact diagram whereby the efficiency of induction motors, when tested by the modified Hopkinson method, is accurately obtained for both motor and generator. Lastly, a method for calculating these results is deduced, and checked by means of the diagram.—Lond. *Electrician*, May 14.

Cooling of Enclosed Machines.—A note on a recent British patent (7203, 1909; May 6, 1909) of Brown, Boveri & Company. A totally enclosed machine is provided with a special foundation having openings coinciding with similar openings in the base of the machine. The rotor of the machine sets up a continuous circulation of the air through the machine and the hollow foundation, and ribs or coils with water circulating through them are placed within the latter to cool.—Lond. *Elec. Eng'ing*, May 13.

Lamps and Lighting.

Tungsten Lamp.—An illustrated description of the English factory in which the "Z" lamp is made. While zirconium is used during the process of manufacture, the finished filament is nearly pure tungsten. The lamp is of the multiple-filament pattern, and its filaments are of the hairpin shape, grouped around a central glass support and connected in series. The filaments are supported by carbon hooks attached to the center stem by thin steel wires. The combination of steel wire and carbon hook forms a spring support which compensates for the expansion and contraction of the filament and at the same time damps the vibrations. The center stem is a glass rod, to which are attached the steel wires mentioned above and the usual nickel supporting wires at the other end of the filament. The center stem is attached to the foot of the lamp, which contains the leading-in wires to which the filaments are welded. A "special salt," which prevents blackening of the lamp, is painted on the center stem. The arrangement of the lamp factory is described. In the exhausting department two types of pumps are employed, the large "Berrenberg" mechanical pump and the more usual rotary mercury pump. With the Berrenberg pump some 200 or 300 lamps can be exhausted simultaneously instead of 10 or 12 with the ordinary rotary mercury pump. It is claimed that the vacuum produced is as high as with ordinary mercury pumps. The life curve of the lamp is shown in Fig. 2.

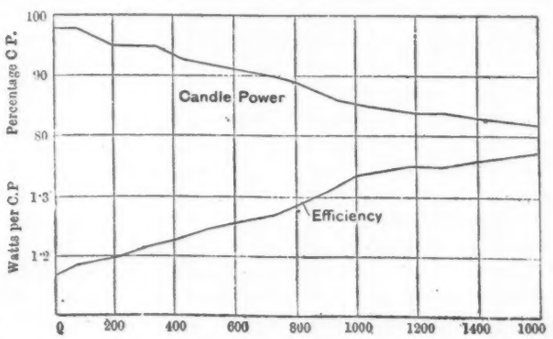


FIG. 2.—LIFE CURVES.

The candle-power is maintained above 80 per cent of the initial candle-power after 1600 hours of burning. The initial consumption is about 1.15 watts per candle, and there is an average loss of 1 per cent in candle-power for each 100 hours of burning. The company is at the present time also manufacturing a 200-volt lamp.—Lond. *Elec. Eng'ing*, May 13; Lond. *Elec.* Review, May 14.

Flame Arc Lamps.—P. HOEGNER.—An illustrated translation of his recent German paper on the regulation of alternating-current flame arc lamps. Attention is called to the importance of the resistance variations occurring in alternating-current arc lamps in the arc gases, and to the fact that if choking coils are used in place of series resistances, the efficiency is improved nearly 40 per cent.—Lond. *Electrician*, May 14.

Vapor Lamp.—O. VOGEL.—The first part of an illustrated article on the evolution of the mercury vapor lamp and the present status of its development.—*Zeit. f. Beleucht.*, May 10.

Power.

Oil Engines for Medium-Sized Power Stations.—A. J. J. PFEIFFER.—An illustrated paper read before the (British) Inst. Elec. Eng. on the economies of medium-sized power stations, with a comparison between steam, gas and oil engines. A description is first given of the principle and operation of the Diesel oil engine; and a comparison is made of the capital and operating costs of steam, gas and oil plants respectively to deal with a maximum load of 1600 kw. Tables and diagrams are given which show that "the internal combustion oil engine working on the Diesel principle possesses advantages both from a technical as well as a commercial standpoint which will make this type of prime mover a most important factor in future central-station practice. Its limit of application depends pri-

marily upon relative fuel costs, which for Great Britain would mean that it probably cannot compete with steam and gas engines in the immediate neighborhood of coal centers. For colonial and foreign work where coal costs are high, it undoubtedly possesses overwhelming advantages." A comparison is finally made of the capital investment and operating costs of substation distribution versus local oil-engine plants. The author shows that under certain conditions the local Diesel plants can be operated cheaper than a large central-station system distributing power to outlying converter substations.—Lond. *Electrician,* May 14.

Fuel Economy.—J. Izart.—A continuation of his illustrated serial on fuel economy in power stations. In the present instalment the author deals with the construction and use of carbon dioxide recorders.—*L'Industrie Elec.,* May 10.

Machine Tools.—A. Comet.—The first part of an illustrated article on the electric driving of machine tools with special reference to group driving and individual driving.—*La Lumière Elec.,* May 8.

Boiler Regulations.—A. Lang.—A review of the modifications in the old boiler regulations to be put in operation in Germany in 1910.—*Elek. Zeit.,* May 13.

Traction.

Single-Phase Traction.—W. Heyden.—The conclusion of his long illustrated description of the electric railroad from Rotterdam to Haag and Scheveningen. The single-phase traction system is used, each car being equipped with two series motors, each of 180 hp. The railroad was opened in October, 1908, and the results obtained are satisfactory.—*Elek. Zeit.,* May 13.

Overhead Construction.—P. Dawson.—A continuation of his long serial on electric traction on railways. In the present instalment the author discusses the various forms of single catenary construction adopted both in Europe and America.—Lond. *Electrician,* May 14.

Meters for Tramways.—A review of the results of the inquiry made by the International Tramway & Light Railway Association on the use of meters on tramways. A simple time-meter which indicates only the total time during which the current was switched on, seems to find most favor; it is used in 21 of the tramway systems which replied to the inquiry. Watt-hour meters are employed on 13 systems, and amp-hour meters only on three systems. The advantages of the use of these different types are briefly discussed.—*L'Industrie Elec.,* May 10.

Installations, Systems and Appliances.

Electricity Stations.—H. M. Hobart.—A continuation of his article on the rating and cost of steam-driven electric generating stations. The author gives tables showing the total cost and annual capital expenses of stations of various sizes. He believes that the use of these tables reduces the design of electricity supply stations to a much more rational process than that heretofore customary. The article is to be concluded.—Lond. *Elec. Review,* May 14.

Tariffs.—L. George.—The conclusion of his long article in which he discusses the different tariffs for charging for electrical energy. In summing up, he thinks that it is impossible to recommend one tariff to the exclusion of others. The tariff must be suited to the conditions of each case, and the author thinks that a distinction should be made between large and small consumers. Some general recommendations are made.—*L'Industrie Elec.,* May 10.

Motor Starter.—A note on a recent British patent (15,013, 1908; May 6, 1909) of G. C. Fricker for a starter which permits a gradual starting up of the motor. It comprises a high-resistance solenoid connected across the motor armature and a plunger partially immersed in mercury. The motor is switched on with a starting resistance in series, and as the speed rises, the pressure across the solenoid increases and the plunger is drawn into the mercury. The mercury rises and successively makes contact with wires dipping into the mercury chamber, which short-circuit portions of the starting resistance in succession. When the motor has attained full speed, the mercury reaches the top contact and cuts out all resistance. For motors taking more than 50 amp it is proposed to connect relays to the mercury contacts, which relays will operate solenoid switches for cutting out the starting resistance.—Lond. *Elec. Eng'ing,* May 13.

Load Factor and Power Costs.—Three papers by E. W. Lloyd on the load factor; by C. A. S. Howlett on load factor and rates; and by J. M. S. Waring on the relation of load factor to power costs; with an account of the long discussion which followed at the presentation in Chicago and in which Abbott, Gilchrist, King, W. B. Jackson, Junkersfeld, Atkin, Babcock, Postel, Lyman, Storey, Hecht and Bushnell participated.—*Jour. Western Soc'y of Eng.,* April.

Electrophysics and Magnetism.

Impurities in Aluminum.—H. Pecheux.—An abstract of a paper read before the Paris Academy of Science on the influence of impurities (especially iron, carbon and silicon) on the thermo-electric properties and the electric resistivity of aluminum. The presence of iron and silicon increases the electric resistivity of aluminum, and the temperature coefficient is higher, the greater the proportion of impurities.—*L'Industrie Elec.,* May 10.

Resistors in Parallel.—M. Kroll.—A brief discussion of a graphical method for determining the joint resistance of several resistors in parallel.—*Elek. und Masch.* (Vienna), May 9.

Electrochemistry and Batteries.

Electric Smelting.—F. W. Harbord.—A paper read before the West of Scotland Iron and Steel Institute. The author divides electric furnaces into induction furnaces, resistance furnaces, and arc furnaces, and discusses especially the use of the electric furnace for the iron and steel industry. He is of the opinion that steel, equal in all respects to the best Sheffield crucible steel, can be produced in any good type of electric furnace at considerably less cost; that steel of the very highest quality, exceptionally low in phosphorus and sulphur, and distinctly superior to ordinary open-hearth metal, can be produced by refining either Bessemer or open-hearth steel at a very small cost in England; and that, by carrying the process of refining still further, at a very small additional cost steel equal to crucible steel can be obtained. Further, under favorable conditions as to cost of raw materials, especially if a surplus of blast furnace gas is available for generating electrical energy, ferro-silicon and similar alloys can be produced at a cost to compare favorably with imported material produced from water-power. With regard to pig-iron this can be produced of any grade and of satisfactory quality, but the electric furnace cannot compete commercially with the blast furnace under the conditions existing in England and other countries, where fuel is cheap.—Lond. *Elec. Review,* May 14.

Units, Measurements and Instruments.

Electromagnetic Balances.—G. Zindel.—In connection with the new electromagnets designed by Weiss, the electromagnetic balance of Cotton is described, which permits the easy and accurate measurement of magnetic fluxes provided the lines of flux have an approximately horizontal direction in the space

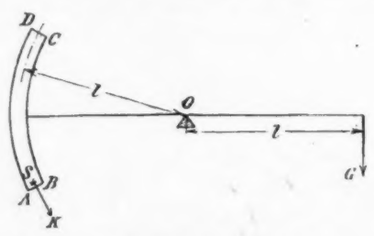


FIG. 3.—ELECTROMAGNETIC BALANCE.

which is being investigated. The Cotton balance differs from the ordinary balance only by the fact that, as shown in Fig. 3, one arm carries at its end the loop *ABCD*. The balance itself

is shown in Fig. 4. The arcs *AD* and *BC* are parts of circles with the center o. The straight lines *AB* and *CD* are parts of radii. For making a measurement, the conductor *AB* is brought into the flux to be determined, the lines of flux being perpendicular to the loop *ABCD*. If an electric current passes then through the loop, the magnetic flux exerts a force on the loop. The forces corresponding to *AD* and *BC* do not have to be taken into account because the direction of these forces passes through o so that the torque is zero. Further, the loop *ABCD* is made so large that *CD* is outside of the flux. The only useful torque is, therefore, due to the arm *AD* and if the radius *r* is made equal to the other arm of the balance, weights placed on the other arm measure directly the torque, from which the magnetic flux intensity may be found directly. Even unskilled investigators when using this balance will get an accuracy of ½ per cent.—*Elek. Zeit.*, May 13.

Water Rheostats.—F. Ross.—A description of a device which avoids resistance changes with stationary electrodes due to the

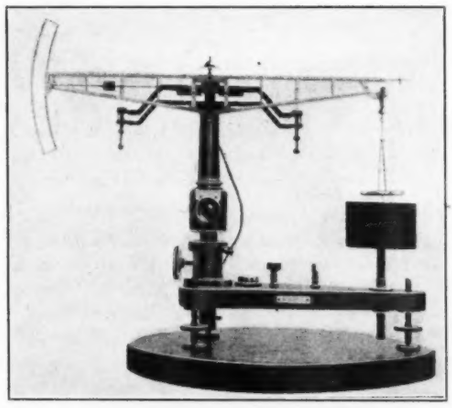


FIG. 4.—VIEW OF BALANCE.

change of the level of the water. When the water supply has been adjusted according to the load to be expected, the lowering or raising of the vessel *c* in Fig. 5 permits adjusting the water level in *a*. By means of the solenoid the arrangement can be adjusted to constant resistance and rendered automatic. —*Elek. Zeit.*, May 13.

Electromagnets for Laboratories.—G. ZINDEL.—An illustrated description of electromagnets designed by Weiss for laboratory purposes. On account of very careful design they give a flux 10 per cent higher than the usual electromagnets. With an exciting current of 53 amp (about 200,000 amp windings maximum) it produces a flux density of 46,000 gauss. The coils are artificially cooled, and this also results in a constant temperature of the air-gap and prevents a reduction of the length of the air-gap during the experiments. The length of the air-gap is regulated by a micrometer.—*Elek. Zeit.*, May 13.

Wehnelt Interrupter.—P. BARY.—The conclusion of his article

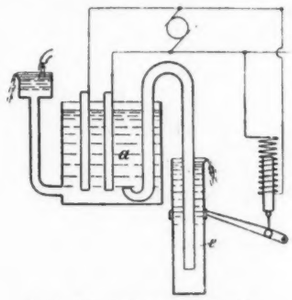


FIG. 5.—WATER RHEOSTAT.

on the theory of the Wehnelt interrupter, considered as a consequence of the pinch phenomenon. The formula, which gives the influence of frequency, is derived from this theory and compared with measurements.—*La Lumière Elec.*, May 8.

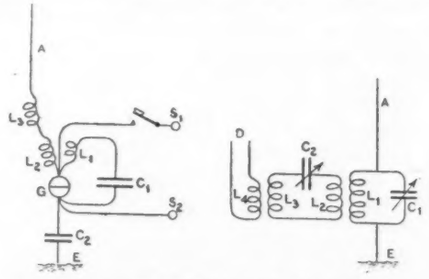
Quadrant Electrometer.—E. ORLICH.—The first part of an illustrated paper giving an account of an investigation made in the German Reichsanstalt on the use of the quadrant electrometer for alternating-current measurements.—*Elek. Zeit.*, May 13.

Air Pump and Vacuum Meter.—U. VON REDEN.—An illustrated description of a new mercury pump and a new vacuum meter. The advantage of the latter compared with the instrument of MacLeod is the small amount of mercury required; for this reason the new vacuum meter permits with greater exactness the measurement of very high vacua.—*Phys. Zeit.*, May 1.

Radiation Pyrometer.—An illustrated description of a modification of the Fery radiation pyrometer. In the ordinary form of this instrument the radiation is concentrated on the junction of a thermo-couple. In the new type a small strip made of two metals with very different coefficients and coiled to the shape of a spiral is used instead of the thermo-couple. The spiral unrolls when heated and the pointer marks the movement of a scale.—Lond. *Eng'ing*, May 14.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—An illustrated description of the Lepel system of wireless telegraphy. This is called a "spark system" in counterdistinction to the "arc system," all of which have one feature in common, viz., that energy is taken from the supply circuit throughout some portion, or phase, of every cycle of the high-frequency current. This distinguishes the arc from the spark, in which latter no energy is taken from the supply circuit during the existence of the oscillatory current, which therefore dies out very rapidly, since its total energy was stored in the potential form in the condenser before the discharge commenced. In ordinary "arc" generators of high-frequency current, energy is taken from the supply circuit during one-half of each cycle of the high-frequency current; in Marconi's generator it is taken during both halves of a cycle. In ordinary spark systems the number of sparks per second has no relation to the frequency of the current produced, the spark rate being controlled by such external arrangements as an electromagnetic or mechanical break in the primary circuit or by the frequency of a low-frequency alternator. Thus it is not possible to maintain a continuous high-frequency current in any circuit of the generator. Even if the spark rate be high it has no relation to the current frequency, hence successive sparks in general commence with a current out of phase with the tail end of the jig, which may exist in the circuit if the damping be low enough. If, however, as in the Lepel system, the discharge rate be controlled by the high-frequency current itself, a continuous high-frequency current of only slightly varying amplitude is produced in the transmitting circuit. Fig. 6 shows that transmitter where *A* is the aerial wire; *G*, the generator; C_1C_2, capacities; L_1L_2, coupled inductances; L_3, aerial inductances, and S_1S_2, the supply terminals. The current in C_1, *L*, *G* has usually the same frequency as *A*, L_2, L_3, *G*, *E*. Fig. 9 shows the receiver in which C_1C_2 are variable capacities, $L_1L_2L_3$ inductances in tuned circuits, L_4 coupling of detector



FIGS. 6 AND 7.—DIAGRAM OF CONNECTIONS.

circuit *D* to intermediate circuit. The generator *G* consists of a box which contains flat metal plates about 3 in. in diameter, which constitute the electrodes of the discharge gap. These are separated by one or two thicknesses of thin paper at the

center, where a small hole is cut in the paper leaving only air between the plates. The paper burns very slowly as the discharge proceeds, one piece often sufficing for from two to three hours' continuous working. A sliding contact on the principal spiral L_1 gives the wave-length adjustment, and the outer, or aerial spiral is hinged so that its mutual induction with the other can be varied within wide limits. In an editorial note, reference is made to the claim of the Lepel Wireless Syndicate that the new system of the Telefunken Company is "a conspicuously spurious imitation" of the method devised by Von Lepel. As to the Lepel system it is thought that "the method of generating is at the bottom merely a mechanical variant of the cooled Poulsen arc in a hydrogeneous atmosphere produced by the burning of the paper; but it is an adaption in which the mode of ensuring a constant arc length and of supplying the necessary atmosphere is of surpassing ingenuity and perfection."—Lond. *Electrician*, May 14.

Wireless Telephony.—E. Nesper.—An illustrated description of arrangements for wireless telephony, due to Poulsen, Ruhmer, Ges. f. Drahtlose Telephonie, Eisenstein, De Forest, Colin and Jeance, Collins, and Majorana. All arrangements which have so far proved successful make use of an arc for the production of high-frequency oscillations, employing one or several devices of Poulsen.—*Elek. Zeit.*, May 13.

Miscellaneous.

"Electric Fire."—In consequence of the breakdown of a tramway feeder cable in the Knott Mill district of Manchester, a water main crossing the iron pipe in which it was laid was made alive, and this resulted in an outbreak of fire in two buildings through ignition of the gas supply. The fires were under control, however, before serious damage was done, and the tramway service in the district was restored in a few hours. —Lond. *Elec. Eng'ing*, May 13.

Electrical Industry in Austria.—E. Honigmann.—The conclusion of his lecture giving a review of the electrical industry in Austria in 1908. He deals especially with the conditions of manufacture, the progress of electric traction, and the reaction of legislation on the industrial conditions in Austria in 1908.—*Elek. und Masch.* (Vienna), May 9.

NEW APPARATUS AND APPLIANCES

Goubert "Multipass" Feed-Water Heater.

The accompanying illustrations show a new type of Goubert feed-water heater, known as the "Multipass" heater, recently introduced by the Goubert Manufacturing Company, New York, and made in sizes of from 50 hp to 5000 hp. This apparatus is guaranteed by the manufacturers to heat feed water from ordinary temperature to within 10 deg. of the temperature of the exhaust steam. Referring to the illustrations, the heater consists essentially of two cast-iron water chambers connected together by a cluster of small, straight brass tubes, which in turn are enclosed within a cylindrical cast-iron shell extending from one water chamber to the other. The ends of the tubes are rolled into steel tube plates in the same manner as boiler tubes are rolled into the manifold. The cast-iron shell surrounding the tubes merely provides an envelope for the exhaust steam, and is of larger diameter than the water chambers, to form an annular belt from which the steam may enter among the tubes from all directions. The exhaust steam enters the shell by the upper opening shown at the right, and what does not condense passes out the lower opening. That which is condensed on the tubes flows to the bottom of the shell and passes out through a drip pipe. It is claimed that with this construction oil or grease in the steam is removed as in an oil separator and passes off with the drip, leaving the remainder of the exhaust steam in the best possible condition for heating systems and other purposes where live steam is sometimes used, but which must be free from all impurities.

FIG. 1.—VERTICAL MULTIPASS FEED-WATER HEATER.

A great advantage of having the water within the tubes, as in the Goubert heater, is that the scale may be removed without taking down the heater. It is obvious that by removing the top chamber the tube interiors can be examined and cleaned out with little difficulty. Any sediment which falls, either during cleaning or operation, goes down into the bottom of the lower water chamber, from which it may be drawn out through the bottom blow-off openings. But the particular advantage of the water-tube construction is that which gives the Goubert heater its name "Multipass." As will be noted, there are baffles so placed in the upper and lower chambers that the feed-water entering at the bottom must travel back and forth through several sets of tubes, and be subjected to the heat of the steam several times before it can reach the outlet at the top. In a 700-hp heater, the instance (handling 21,000 gal. of water per hour), there are 100 tubes, each 1 in. in diameter and over 7 ft. long. The feed water must travel five times the length of these tubes in the path of the steam, which gives every opportunity for absorbing the largest practicable amount of heat.

The Goubert heater is provided with an expansion joint between the upper chamber and the shell. The upper chamber is supported entirely by the tubes and left free to move up and

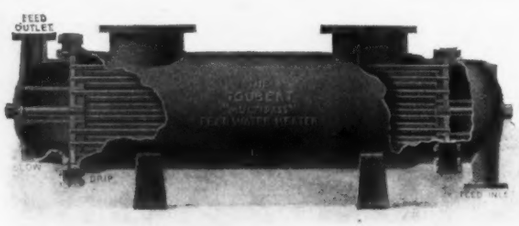


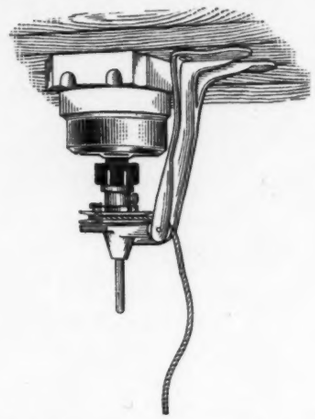
FIG. 2.—HORIZONTAL PATTERN.

down. The expansion joint is fitted with a flexible ring gasket composed of layers of soft copper and special packing with wire interwoven. The inner edge is clamped between the shell and an annular ring. The only purpose of this gasket is to prevent steam from escaping into the room, and as it is subjected to no other pressure than atmospheric, the gasket will last for years. Its renewal amounts to nothing more than the replacing of a cylinder head or steam pipe gasket.

While the vertical construction as described is preferable for installations where there is not sufficient head room, as in the cellars of city buildings, the horizontal heater shown in Fig. 2 can be used. This has the same essential features as the vertical type, and is also useful in connection with condensing engines. If it is desired to suspend the horizontal heater from the ceiling, the feet may be replaced by straps, lugs or bolts for that purpose.

Pull Attachment for Snap Switches.

Thomas J. Burke, of the Burke Electrical Works, of New Orleans, La., has devised the attachment for snap switches illustrated herewith. The leg of the device is attached to the ceiling by two common wood screws, or if the ceiling be of metal by toggle bolts. The Code requiring snap switches to have an insulating or hardwood base, the leg is made long enough to take in the switch and base. The metal parts of the device do

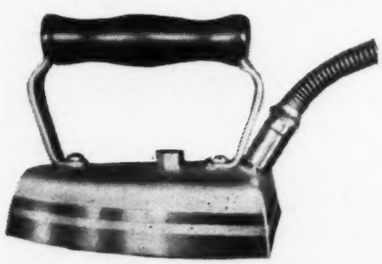


PULL ATTACHMENT FOR SNAP SWITCHES.

not touch the current-carrying parts of the switch, but grasp the switch handle so that there is no danger of shock attending its operation. By means of a sliding shaft the device may be made to operate a switch of smaller dimensions or one set flush with the ceiling. In conduit work the mechanism can be placed adjacent to the switch in the conduit. By means of a cord or chain passed around a grooved disk and over a pulley the switch may be opened or closed, a spring-and-ratchet arrangement returning the grooved disk to normal position after each pull.

The Harwood Electric Iron.

The Harwood Electric Heating Company, of Hutchinson, Kan., has made a number of changes and improvements in its electric iron, the latest form of which is illustrated herewith. The entire bottom of this iron constitutes a heating element. This bottom is a heavy piece of cast iron, one side of which is the polished working surface. The top of this piece has a raised portion in which slots are cut in the solid metal, and in these slots the resistance wire is placed in zigzag form between sheets of mica. As the heat has but a short path through these mica



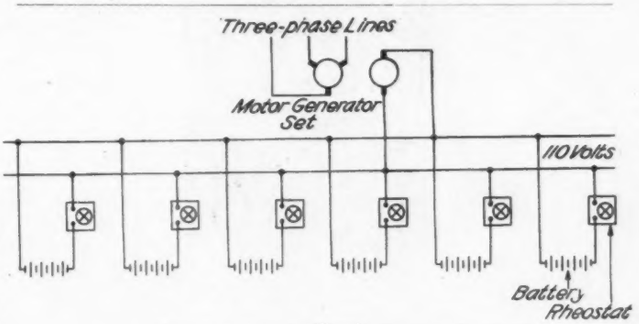
ELECTRIC IRON.

sheets to the sides of the slot, there is good heat conductivity away from the resistance wire into the metal of the iron. The mass of metal in the bottom of this iron constitutes a heat storage which will maintain ironing temperature for a considerable length of time. The resistance material not being rigidly held by cement or enamel to the body of the iron, it is not subjected to breaking strains caused by the expansion or contraction of the iron. Realizing that the plug or connector has been the weakest point of many irons, this company has perfected a new switch plug which provides for contacts of some flexibility embedded in porcelain. The porcelain insulation has a metal case which protects the switch plug from breakage. Spiral springs of piano wire are provided between the porcelain and the metal case. These give considerable flexibility to the terminal receptacles.

Battery Charging in Automobile Garages with Mercury-Arc Rectifiers.

In many electric automobile garages having a capacity for charging two or more batteries at one time, the charging is done directly from direct-current feeders or through a motor-generator set from alternating-current feeders. The general connections are similar to those shown in Fig. 1, either with or without the motor-generator. There are a small number of garages using single-circuit rectifier outfits, one for each battery to be charged, but while this method is very satisfactory and highly efficient, the cost of the original installation is rather more than most garages care to invest for this purpose. A large number of charging garages are now using the public-garage type of rectifier, which is described later in this article.

Referring again to Fig. 1, let it be assumed that six batteries are to be charged from the 110-volt circuit, and that the number of cells in the various batteries is as follows: No. 1, 44; No. 2, 40; No. 3, 30; No. 4, 24; No. 5, 16; No. 6, 12. The tabulation in Fig. 1 shows the actual watts delivered to the battery, the watts lost in the rheostats and the efficiency of each circuit, neglecting the loss in the motor-generator set. It will be seen from the last column that the efficiency of the complete system, exclusive of the motor-generator set, will be about 58 per cent; with the motor-generator set having an approximate



	Circuit.						
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Totals.
Number of cells	44	40	30	24	16	12	166
Volts, average.	101	92	69	55	37	28	...
Amp., average.	20	20	20	20	20	20	120
Watts used....	2020	1840	1380	1100	740	560	7640
Watts lost.....	180	360	820	1100	1460	1640	5560
Watts, total...	2200	2200	2200	2200	2200	2200	13,200
Per cent efficiency	92	84	63	50	34	25	58

FIG. 1.—DIAGRAM OF CONNECTIONS AND TABLE FOR CHARGING GROUP OF BATTERIES FROM MOTOR GENERATOR.

efficiency of 75 per cent, the efficiency of the system will average about 44 per cent.

The public-garage type of mercury-arc rectifier is shown in Fig. 2. This outfit is designed for use on a 220-volt, 60-cycle alternating-current circuit and consists of a two-panel, dull-black slate switchboard with necessary regulating compensator, reactance, equalizing rheostats, rectifier tubes and switches, all suitably mounted with a view to obtaining the most compact and convenient equipment possible. The left-hand panel of the switchboard is known as the rectifier-controlling panel, and on it is mounted the apparatus particularly essential to the starting of the rectifier tube and regulation of the rectifier current. The right-hand charging-circuit panel is equipped with six triple-pole, double-throw switches which lead to the various charging circuits; two 60-amp ammeters and a six-point voltmeter switch for adjusting one of the voltmeters on

the left-hand panel for reading the voltages of the various batteries being charged.

The general scheme of connections of the charging circuits on the garage panel is outlined in Fig. 3. The rectifier when charging a group of batteries similar to that shown in Fig. 1 would supply an average of about 193 volts on the charging circuit. It will be noted from Fig. 3 that the six batteries are arranged in two circuits of three batteries each, the batteries being equally divided between the two circuits. The tabulation just below the diagram gives the losses and efficiencies when charging with these connections. It will be noted from this table that the average efficiency of the charging circuits alone, neglecting the very small losses in wiring, is 99 per cent. As the efficiency of the rectifier when delivering 193 volts is about 84 per cent, the total combined efficiency of the complete charging equipment would be about 82 per cent.

Referring to the table in Fig. 1, it will be seen that the total watts used in the charging circuits is 13,200. At 75 per cent efficiency this would mean an input to the motor-generator set of about 17.6 kw. The input to the rectifier under the conditions shown in Fig. 3 would be about 9.2 kw, representing a saving of 8.4 kw for each hour of operation under similar conditions. Of course, a part of this saving would be diverted

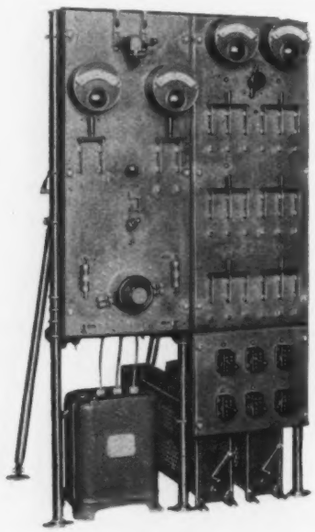


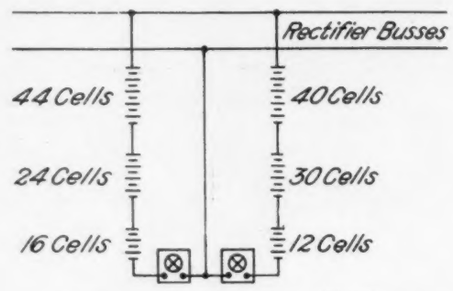
FIG. 2.—PUBLIC GARAGE TYPE OF RECTIFIER.

to the purchase of renewal tubes for the rectifier, but even considering the slight additional expense, it is claimed that the saving in power could figure out at least 20 or 25 per cent.

While some garage operators might consider the combination of cells given in the foregoing example as an unfavorable case, it should be borne in mind that batteries of the various number of cells mentioned are furnished by representative electric vehicle manufacturers for use in their "electrics." Nor is it possible for a garage to control the conditions and make them most favorable to the charging plant. For example, garages are frequently called upon to charge a single battery with a large number of cells, say, a 40-cell battery, and a large number of batteries with a smaller number of cells, for instance, five 24-cell batteries. When charging such a group of batteries from a 110-volt direct-current circuit the efficiency would be about 44 per cent. When charging the same batteries with a rectifier, the efficiency would be about 75 per cent.

In the accompanying tabulation of efficiencies when charging various sizes of batteries, for the purpose of comparison, the charging rate on all batteries is taken as 20 amp, and the average volts per cell as 2.3. While some batteries are designed for a heavier charging rate, the average battery can be efficiently and economically charged at this rate, although the time of charging may be somewhat longer. There are, of course, almost innumerable combinations of batteries possible, but the above will give the general basis for comparison between the various methods of charging.

It will be noted from Fig. 4, which is a complete diagram of connections of the rectifier garage set, that when a battery is connected to the terminals of each of the triple-pole switches marked + and —, with the switches thrown in the upper position the batteries are connected in two series groups similar to Fig. 3. If all the 12-cell batteries are to be charged at one



	Circuit. No. 1.	Circuit. No. 2.	Totals.
Number of cells	84	82	166
Volts, average	193	189	...
Amperes, average	20	20	40
Watts used	3860	3780	7640
Watts lost	...	80	80
Watts, total	3860	3860	7720
Per cent efficiency	100	98	99

FIG. 3.—DIAGRAM OF CONNECTIONS AND TABLE FOR CHARGING CIRCUITS FOR GARAGE OUTFIT.

time, they may be placed in series by simply reversing the position of a double-pole, double-throw switch on the left-hand panel. For practically all charging, however, the circuits will be connected in series multiple, as shown in Fig. 3.

In each of the two series-charging circuits is connected a 60-amp ammeter and a rheostat for equalizing the current between the two circuits. In order to use as little of the resistance as possible, the number of cells of battery should be arranged to be as nearly equal as practicable. When it is desired

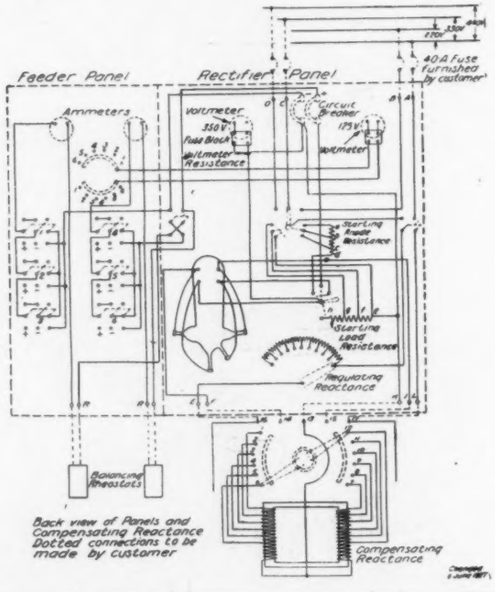


FIG. 4.—DIAGRAM OF CONNECTIONS OF RECTIFIER OUTFIT.

to cut out a battery for any reason, the switch to which this battery is connected should be opened, a sufficient amount of the charging rheostat cut in and the switch thrown into the upper position. This cuts out the battery, but the series circuit is not broken and the charging of the remainder of the batteries will be continued.

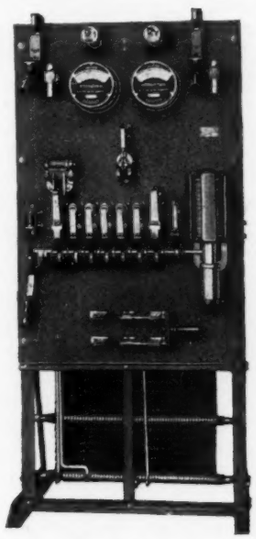
A sub-base, shown below the right-hand section in Fig. 2, is

sometimes furnished. This sub-base is equipped with six non-reversible plug receptacles and six charging plugs. To these plugs should be attached six charging cables leading to various points in the garage. The use of this sub-base permits of readily changing the various batteries under charge from one circuit to the other in order to make the most efficient combination without moving the vehicles from place to place in the garage. With this type of rectifier it is possible to charge at one time a total of 180 cells of lead-plate battery at 20 amp each.

About 30 of these garage panels are now in actual service giving excellent results and, in practice, are stated to prove that the above efficiencies outlined are not merely theoretical.

Fire Pump Electric Starter.

The apparatus shown in the accompanying illustration is designed primarily for the control of motor-driven fire pumps, and finds its widest use in connection with centrifugal underwriters' pumps operating on sprinkled systems. Its purpose is to start and stop the pump automatically on variations of pressure in the system, thus maintaining a constant pressure available in case of fire. It is also so designed that the pump may



FIRE PUMP ELECTRIC STARTER.

be readily started by hand for test purposes or in case of fire should the automatic feature fail. The cut shows one of these starters complete with accessories, including circuit-breaker, ammeter, voltmeter, main-line knife switch, etc., for controlling a 100-hp, 220-volt motor-driven underwriters' fire pump recently installed in Chicago.

The apparatus consists simply of a combined line switch and rheostat, so designed that it can be operated both automatically and by hand. The main line and accelerating switches consist of a series of crank-operated switches closed mechanically and successively by means of cranks on a revolving shaft. This shaft is revolved either by a solenoid through the medium of a rack or pinion, or by a hand lever. A pneumatic governor, connected to the pressure tank into which the pump discharges, controls the circuit of the solenoid, opening and closing said circuit on predetermined limits of pressure, thus energizing and de-energizing the solenoid to start and stop the motor automatically.

To start the motor by hand, the lever at the end of the shaft is gradually raised to a vertical position revolving the shaft through half a revolution, closing the switches in succession and bringing the motor to speed. The lever is held in the running position by a retaining magnet, thus providing the no-voltage release feature. Upon failure of voltage, the lever and solenoid plunger drop to the off position, opening the switches, reinserting the armature resistance and opening the motor circuit. The crank switch which is used to make and break the motor circuit consists of a laminated brush with auxiliary carbon contact and is provided with a powerful blow magnet to disrupt the arc. The accelerating switches have heavy "butt end" carbon contacts and all burning and arcing are practically eliminated. The solenoid plunger is retarded by means of a vacuum dash-pot which may be easily adjusted to govern the rate of acceleration of the motor.

In some cases it is desired to provide for a speed regulating feature for increasing the speed of the motor 10 per cent over normal, thus increasing the capacity of the pump in case of emergency. For this purpose a single magnet switch, controlled by push buttons on the panel, is provided, which inserts the required resistance in the shunt field of the motor. The circuit of this switch is controlled by the rheostat in such a way that it is impossible to start the motor with weakened field.

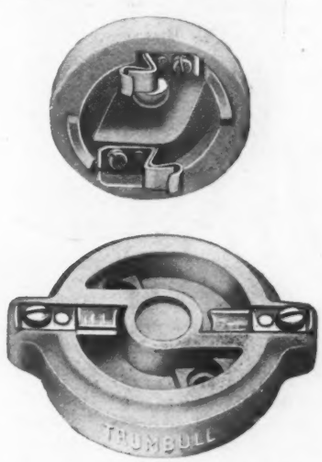
The advantages of this type of starter for fire-pump service lie in its extreme simplicity. The entire automatic feature is controlled by one coil and the hand operation is accomplished by means of one lever. Furthermore, the same rheostat contacts and resistance are used for both operations, and at the same time either control is absolutely independent of the other. All sliding contacts and delicate relays are entirely eliminated and the rugged construction and simplicity of operation make the outfit ready for action under all conditions.

The apparatus described is made by the J. L. Schureman Company, Chicago, Ill.

Fusible and Fuseless Rosettes.

The Trumbull Electric Manufacturing Company, of Plainville, Conn., has just put on the market a complete new line of two-piece rosettes, fusible and fuseless, of the cleat, concealed and molding types. The caps are interchangeable, any cap fitting any base. In designing this new line, particular attention was given to the chief difficulty found in most rosettes, namely, that of the cap loosening or jarring off from the base. The manufacturers state that before marketing the present line of rosettes they were put through various and severe tests, which showed that their construction prevents the caps being loosened from the base by jars.

This result is attained, in addition to great care in assembling, first, by the use of a strong bronze spring of an especially wide range, which follows the contact in the base and holds the

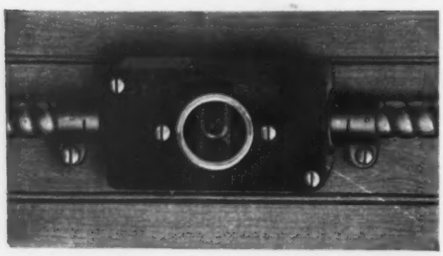


FUSIBLE AND FUSELESS ROSETTES.

caps securely at all times; and, second, by a unique point in their construction whereby the contact pieces are struck off at an angle in such a way that when strain is put on they are drawn still tighter together. The more the weight thus the closer the contact. The rosettes are easy to wire, the space for lamp cord being ample, the binding screws heavy and substantial; and while the base and cap are easy to assemble, yet considerable pressure is required to take them apart.

A Multilet Box and Receptacle.

The accompanying illustrations show the Sprague "Multilet" box with cover fitted with a receptacle, which can be seen within the box. Unlike many other sign and outlet box receptacles the one illustrated is particularly adaptable to Sprague "Multilets" for the reason that the screws securing the wire connections to the clips of the receptacle are tightened from the face of the receptacle and not from the back. This obviates the necessity of having long wires within the box, an advantage which will be quickly appreciated by the wireman.



FIGS. 1 AND 2.—MULTILET BOX AND RECEPTACLE.

Sign and Decorative Lighting with Tungsten Lamps.

Recently low-voltage tungsten lamps of various sizes from the miniature up have been perfected and on account of their comparatively thick and short filaments, these lamps stand harder usage and have a longer life than the higher-voltage tungsten lamps. By using a special transformer stepping down from 110 to approximately 10 volts the use of these low-voltage tungsten lamps is made possible. The ordinary 4-cp carbon sign lamp consumes a total of 19.28 watts per lamp as compared with a total consumption of 5 watts in the case of the 4-cp tungsten lamp. As the saving is in a ratio of substantially 4 to 1, the commercial possibilities and desirability of this new combination are obvious. Moreover, the increased cost of the tungsten sign lamp is largely counterbalanced by the increased life, which will frequently reach 2000 hours.

TRANSFORMER FOR SMALL CANDLE-POWER TUNGSTEN LAMPS.

In ordinary sign lighting the transformer core losses are proportionately quite high in that signs, like other current-consuming devices, are operated from the regular lighting or power mains, energized 24 hours a day and, therefore entailing a constant core loss in transformers supplying the lamps, a proper percentage of which loss is chargeable against the signs. On the other hand, the tungsten transformer is connected between the control switch and the lamps, so that the core losses only go on while the lamps are burning. Another decided advantage in using the tungsten-lamp transformer for low-voltage lamps instead of placing a group of 10 or so in series across the 110-volt circuit is that any number of lamps can be used and the complete extinguishing of a row of lights is avoided when any lamp burns out. The tungsten sign lamp is also an exceptionally economical medium for the illumination of drug stores, libraries, dens and reception halls, as well as sign and outline work. A transformer for use with small candle-power lamps, made by the Central Electric Company, Chicago, is shown in the accompanying illustration.

Floor Finishing Machine.

The electrically operated floor-finishing machine illustrated herewith is the invention of Rudolph T. Schuttler, of Oshkosh, Wis. The machine is simple in construction, with a horizontal base, in the forward end of which is journaled a vertical shaft. On the lower end of this shaft is attached a hollow disk or buffing wheel, on which is placed the abrasive or polishing material. In the machine illustrated this disk is 7 in. in diameter and is belt-driven by a 1½-hp motor, as shown. Other sizes can be built if desired, but practical demonstration has shown that the 7-in. disk is well adapted for various purposes. The disk makes 2400 r.p.m., and weighs 40 lb. The weight of the whole machine is 175 lb. The abrasive or polishing material is placed on the disk, which is also adapted to contain oil used in finishing floors, the oil percolating through perforations in the lower face of the disk and being used with the felt or other polishing material.

The frame of the machine rests on two wheels, and toward the front end is a caster wheel which allows the machine to be easily moved in any direction. The buffing wheel may be raised or lowered by a lever attached to the handle of the machine and connected by a rod to mechanism provided for that purpose, as shown in the cut. Means are provided for securing the lever in any one of several positions. In operation, however, the disk is said to adapt itself to any surface, apparently following the floor level. The lever and rod simply come into play when it is desired to remove the machine some distance without doing any work with it. In operation the machine is swung from left to right and vice versa after the manner of handling an old-fashioned scythe, and it takes in about 5 ft. of floor surface at a time. The inventor says that he can smooth about 100 sq. ft. of rough, uneven floor surface in an hour by the use of the machine, which is flexibly connected to any suitable source of electricity. After the floor is made smooth the same machine is used to polish it. In working upon new floors abrasive material is first used on the buffing wheel, which will have the effect of a rasp; then sandpaper is used on the disk and lastly this is replaced by felt for the polishing. Mr. John M. Crook, 841 North Fifty-third Avenue, Chicago, is introducing the machine.

FLOOR-FINISHING MACHINE.

Indirect Lighting of the American Radiator Company General Offices.

The general offices of the American Radiator Company, at Chicago, have recently been equipped throughout with indirect lighting from chandeliers placed at the outlets which existed when the former direct system was in use. Besides the general offices, the storeroom on the first floor has also been equipped in this way. The former method of lighting was by means of clusters of incandescent lamps under flat opal reflectors, which

FIG. 1.—DIRECT ILLUMINATION.

gave a general illumination. This was supplemented by individual desk lights placed wherever needed. These offices and the store were wired with an outlet in the middle of each ceiling panel, half of the panels being about 16¾ ft. x 24 ft., and the others 16¾ ft. x 18¼ ft. The outlets had six-light clusters with common carbon 50-watt lamps.

The general plan pursued when the indirect lighting was adopted was to place three 100-watt "I-Comfort" inverted reflector units on a chandelier in place of each six-light cluster. In a few places in the offices where especially good light was needed, four-light chandeliers with 100-watt tungstens were installed. The offices on the second and third floors have 12-ft. ceilings. The fixtures on these floors were made 46 in. over all. The store has 13-ft. 6-in. ceilings and the fixture length is 46 in. On the fourth floor, where there are 18-ft. ceilings, the fixture length was 50 in. over all. These heights were adopted after taking into consideration the areas to be covered and the

FIG. 2.—INDIRECT ILLUMINATION.

character of walls. The walls and ceilings of these offices are nearly white. The store on the main floor has a papered ceiling of a tint which is slightly gray in general effect. In another portion of the building, which has low ceilings and which is occupied altogether by typewriters' desks, one-light units spaced at frequent intervals were used. Altogether there were 53 three-lamp chandeliers, 23 one-lamp and 5 two-lamp chandeliers.

The watts per square foot is about 1 in most of the office space, but varies in different parts of the offices, the maximum being 1.3 and the minimum 0.6. The installation was made after a three months' trial of the indirect system in the accounting room and advertising departments. This company's offices in two other cities are also being equipped in the same way. Fig. 2 shows the store on the first floor of the building equipped with the indirect system. The National X-Ray Reflector Company, of Chicago, furnished the reflectors and fixtures.

Fuse and Service Boxes with Interchangeable Fittings.

The H. W. Johns-Manville Company, of New York, has made a number of improvements in its line of fuse, service and subway boxes suggested by its greater experience in the field. The company has discarded its well-known lobster-claw fuse carried on all low-voltage service boxes and now uses a carrier consisting of steel hooks, simultaneously actuated by a single-cover handle. The new type of service box is shown in Fig. 1.

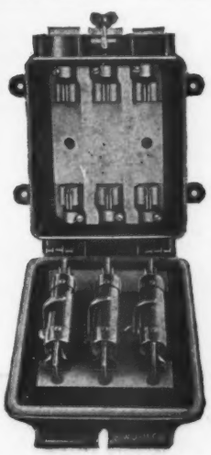


FIG. 1.—SERVICE BOX.

FIG. 2.—RIGHT OR LEFT HAND FITTING.

FIG. 3.—ENTRANCE HOOD.

Each end of the box is provided with a large oval boss, the surface of which is planed, jig-drilled and tapped. The wire holes are provided with porcelain bushings. Where it is desired to employ the box in connection with conduit work, the various fittings shown may be used and attached to the box by means of screws. Ordinarily these fittings are attached to the box without a gasket, but where it is necessary or expedient to secure a water- or gas-tight device, a small rubber gasket may be inserted between the planed surfaces of the fitting and the box. When it is desired to place the fuses in circuit, the handle is

FIG. 4.—STRAIGHT-AWAY FITTING.

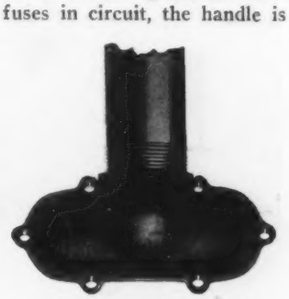


FIG. 5.—BACK ENTRANCE FITTING.

turned so that it points downward. The fuses are then slipped into the aligning clips in the cover and the handle turned so that it points to the right. The cover may then be closed or opened, inserting or withdrawing the fuses. If it is desired to examine the condition of the fuses without breaking the circuit, the handle is given one-quarter of a turn, thereby releasing the fuses and permitting the cover to be operated, leaving the fuses in their clips. The boxes are designed to be used as switches and in a great many instances are accepted in lieu of the usual cut-out and knife switch.

Exhibition Notes---N. E. L. A. Convention

THE exhibits at the National Electric Light Association convention at Atlantic City this year numbered 69. These are divided among 84 booths and the display covers passably well the entire field of electrical activity. Just prior to the general reception and dance on Monday night, the formal opening of the exhibits was announced by the complete illumination of the auditorium on the $1,000,000 Pier in which the exhibition was held. By means of the vari-colored lamps on the ceiling and sides of the vast hall, different color effects were obtained which were very pleasing. Green and white are the prevailing colors in the decorative scheme, and while the booths are easy of identification by means of the signs used, the committee has been at pains to regulate the exhibits and their arrangement so that one does not hide nor detract from another. As indicated in the engravings herewith, a general uniformity prevails in all the booths. Although not contemplated at first, some of the exhibits are of necessity arranged under the gallery on the north side, and a portion of the lower end of the auditorium is occupied by 14 booths. The vast auditorium in front, however, is kept clear for reception and other purposes, and in this way the exhibition feature does not unduly predominate. Outside the pier a number of flaming-arc lamps are kept burning, the rules precluding their continuous operation inside. Following is a list of the exhibits and those in attendance thereon:

FIG. 1.—GENERAL VIEW OF EXHIBITS AT N. E. L. A., ATLANTIC CITY CONVENTION.

Albert & J. M. Anderson Manufacturing Company's booth is presided over by Mr. Ernst Woltmann. The display is devoted principally to time switches of various types and sizes; oil switches for tensions as high as 3000 volts and some for currents as great as 200 amp being among them. The double-pole, double-throw time switch for potentials not exceeding 250 volts is intended for changing the circuit from one meter to another in cases where an increased rate is charged during the peak load or where double rates are in vogue. The switch has no open position. The double-pole, double-branch time switch controls two separate circuits at intervals—that is, closing one before the other and opening both at the same time, or opening one before the other and closing both at the same time. The triple-pole time switch for constant-current transformer circuits is especially interesting. The switch is intended for controlling series arc transformers and their circuits. When all three poles of the switch are closed, the secondary coil assumes such a position that the short-circuiting pole may be opened without causing undue strain on the lamps. This is done automatically by a second action of the mechanism, which throws on the lamps and allows the coil to adjust itself to the load. The company's specialties shown include Ætna insulation, switches and switchboards, heavy copper work, charging plugs and receptacles for automobiles, battery switches, etc. Assisting in entertaining are Messrs. George B. Crane and Alf. Anderson.

Allis-Chalmers Company features a sample board showing the construction of the blading of an Allis-Chalmers steam turbine. A line of transformers, embodying all the latest improvements in design and construction and a portable air compressor mounted on an ordinary four-wheel platform truck, are worthy of note. An induction motor and a direct-current motor are shown, together with a rack containing views in installations of prime movers, including turbines, gas engines, Corliss engines and hydraulic turbines. Representatives of Allis-Chalmers Company in attendance include: Messrs. W. H. Whiteside, M. C. Miller, A. H. Whiteside, J. R. Jeffrey, W. H. Powell, F. C. Randall, Geo. Baiz, C. A. Burns, Harry Byrne, W. G. Clayton, J. T. Cunningham, H. W. Dennison, J. F. Dixon, A. N. Libby, W. C. MacEwen, A. P. Peck, A. F. Rolf, Geo. C. Dresser, W. O. Taylor, L. L. Willard, H. W. Rowley, E. T. Pardee, J. H. Waterman, St. John Chilton, J. B. Nicholson, S. H. Payne, H. H. Pease, E. I. Van Doren, J. C. M. Lucas, A. A. Hutchinson, J. L. Watson, J. F. Shipp, Seldon Jones, B. Moore, O. C. Ross, J. W. Gardner and L. M. Harvey.

The American District Steam Company's exhibit consists of a model of its underground steam mains showing various fittings, etc. Condensation meters, live-steam meters, both of the Holly and St. John type, and models of the various steam specialties manufactured exclusively by the company are also shown. The company's representatives are as follows: Messrs. W. H. Wells, H. J. Babcock, W. J. Kline, H. C. Kimbrough, J. A. Bendure, R. Hall, and Miss R. Shankel, who is in charge of the booth. Detailed data on the operation of district steam-

FIG. 2.—VIEW DOWN ONE OF THE AISLES.

heating plants in connection with electric light and power plants and also data on live-steam plants are available to those interested.

American Electrical Heater Company, while it is not making a special exhibit at the convention, has its interests well taken care of by Messrs. B. H. Scranton and R. Kuhn, who have with them a number of the standard and representative devices made by the company, such as laundry irons, disk stoves, toasters, coffee percolators, etc.

American Electric Lamp Company of New York.—This company's exhibit, located in the center of the exhibition hall, consists of a complete line of samples of every known type and size of American carbon, tantalum, tungsten and metallized filament lamp, from the smallest miniature to the largest tungsten lamp made. In charge of the exhibit is Mr. L. F. Johnston. Mr. C. J. Purdy is also in attendance.

The Anderson Carriage Company displays a roadster and a four-passenger brougham. The features of these vehicles are many, chief among which are the use of ball bearings and double-chain drive. The representatives present are Messrs. G. D. Fairgrieve and E. W. Allen.

The Baker Motor Vehicle Company has placed on exhibition a Queen Victoria and on the street for demonstration purposes is a runabout. The company has sent its chief engineer, Mr. Emil Gruenfeldt, and Mr. Peter Dumont, to explain the superior features of the Baker electrics. In this they are ably supplemented by Mr. O. B. Henderson.

Benjamin Electric Manufacturing Company has a number of display boards and samples on exhibition showing its line of wireless clusters and lighting specialties. An extensive line of new tungsten fixtures is in evidence and literature covering the various devices shown is being distributed. Messrs. B. G. Kodjbanoff, G. C. Knott and H. E. Watson are representing the company during the convention.

The Broc Carriage & Wagon Company was not able to secure space to make an exhibit at the convention, but is represented by Messrs. John B. Stuber and J. H. Janssen, who are making the acquaintance of the central-station managers and taking up the question of electric vehicles with them.

The H. B. Camp Company's exhibit comprises samples of its vitrified clay conduit and some photographs of installations where its duct is used. Messrs. C. C. Baird and R. P. Keasbey are looking after the company's interests.

The Columbus Buggy Company's exhibit consists of a coupé and victoria. The former is on exhibition in the main hall, while the latter is used for demonstration purposes. The company's aim is to interest electric-light men in the present perfection of the electric vehicle and the possibilities of revenue for their plants from the sale of energy for charging batteries. Messrs. R. S. Fend and L. H. Estep are in charge.

Commercial Truck Company has two spaces in the main hall where it is showing a 3½-ton brewer's truck equipped with four-motor, four-wheel drive, which is meeting with such success in heavy hauling problems. An interesting part of the exhibit is the spiral gear drive on a 1000-lb. delivery wagon. The gears and all working parts of this drive are enclosed and the wagon shown is probably the first delivery wagon having such a drive. Messrs. L. A. Tirrill, E. S. Hare and E. R. Whitney compose the representatives of the company in attendance.

Cooper Hewitt Electric Company is showing samples of various types of standard mercury-vapor lamps for direct and alternating current and also its type T lamp, which is a combination of a circular Cooper Hewitt tube and a tungsten. The exhibition space is curtained for demonstration purposes. In attendance are Messrs. C. B. Hill and M. B. Buckman, Jr., the latter having charge of the exhibit.

The Crocker-Wheeler Company has on exhibition a collection of photographs showing its various products, including direct-current motors, induction motors, transformers, etc. Among the representatives of the company present are: Messrs. R. N. C. Barnes, Rodman Gilder, R. J. Randolph and J. R. Lewis.

The Dearborn Drug & Chemical Works, chemists on the treatment of boiler waters and manufacturers of lubricants, has the usual interesting exhibit such as the company arranges each year. Because of the scientific principle originated by this company for the practical correction of boiler waters, its preparations are widely adopted. Representing the company at the convention are Messrs. Robert F. Carr. G. W. Spear, H. G. McConnaughy and Paul T. Payne.

Dossert & Company have on exhibition a number of improvements and new applications of their solderless devices, including elbows for connecting ingoing and outgoing buses through oil switches; lugs for the connection of solid round to flat buses; special lugs for remote-control switches, special two-way studs for tapping from solid rods direct to buses and

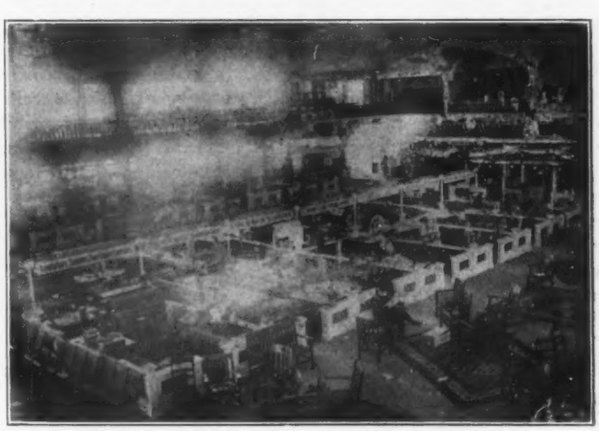


FIG. 3.—VIEW OF EXHIBITS FROM GALLERY.

special studs for transformer connections. Messrs. H. B. Logan and H. S. Shope are in attendance.

Duncan Electric Manufacturing Company has an unusually large display of the various meters which it manufactures, including house type, switchboard type and a rotating standard test meter. Several sizes of transformers are also shown. The house type of meter was placed on the market early this year. All parts are formed up of sheet metal under heavy pressure and the interchangeability of parts is one of the features of the

instrument. The rotating standard test meter is so made that the pointers after each reading are brought back to zero by simply pressing a small button. In changing the field coils for the various loads, the use of plugs, knife or snap switches is not essential. The company's interests are well taken care of by Messrs. Adrian Tobias and William H. Sinks.

Duplex Metals Company is exhibiting copper-clad steel wire in sections of billets showing the reduction from the original size down to the finished product. Duplex wire, rubber insulated and weatherproofed, so as to be suitable for incandescent and arc-lamp circuits, is also displayed. Representing the company are Messrs. Frank R. Chambers, Jr., James F. Kinder and John B. Given.

Economical Electric Lamp Company not only has all of its turn-down lamps on exhibition, but by means of automatic apparatus shows how each of the lamps works. A miniature hand pulls the string by means of which the large filament is turned on and off and the small filament is lighted and extinguished. Messrs. M. and L. Lobenthal are in attendance.

Electrical World booth, facing the registration offices, was a center of attraction on the opening day, delegates and exhibitors vieing with each other in obtaining copies of the convention number, concerning which innumerable favorable and flattering comments were heard. Representing the business department are: Messrs. J. M. Wakeman, G. W. Elliott, W. K. Beard, C. T. Walker, H. T. Matthew, F. V. Clark, W. Wagner and M. Orton. The editorial staff is represented by Messrs. T. C. Martin, W. E. Kiely, J. R. Cravath, W. H. Onken, Jr., and H. S. Knowlton.

Electric Cleaner Company has a working exhibit consisting of several "Positive" electric vacuum cleaners in operation cleaning rugs. An attractive catalog is distributed, together with other advertising matter on the company's product. Mr. J. M. Rodger is in charge of the booth and he is assisted in demonstrating the cleaners by Messrs. C. C. Richardson, A. B. Cousin and a lady demonstrator.

Electric Cleaner Company is demonstrating a number of its vacuum cleaner outfits. The cleaner is said to have a range of from 0 in. to 12 in. vacuum and to operate on 8 in. at the nozzle. The machine is mounted on ball bearings and can be wheeled from room to room with ease.

The Electric Storage Battery Company is showing various types of storage battery cells for central-station service. Prominent in its booth is one of the largest cells in the world, consisting of 131 type H Exide plates, having a capacity of 22,000 amp-hours. Alongside of this cell is shown the smallest cell made by the company, having a capacity of 1 3/5 amp-hours. Inasmuch as interest is being centered on the electric vehicle the company is showing many different types of Exide cells used for automobile and ignition work. A large map, showing the distribution system for Exide material throughout the country, indicates that approximately 600 centers have been established where such materials can be purchased by the owners of electric vehicles. Attracting the eye is an exaggerated meter showing the current consumed by a motor with the vehicle on various grades. A large corps of representatives are present. Among these are: Messrs. Charles Blizard, Frank Stone, R. B. Daggett, G. H. Atkin, E. L. Raynolds, H. B. Gay, Albert Taylor, H. H. Seaman and H. L. Marshall.

The Electric Suction Sweeper Company has on view two sizes of Hoover electric suction sweepers. The 12-in. sweeper is equipped with a ⅛-hp motor and the 18-in. sweeper is driven by a ¼-hp motor, a rotary fan being employed in conjunction with a brush to effect rapid cleaning. The machine is not strictly a vacuum cleaner. It is operated on the plan of centrifugal exhaust and is therefore a departure from rotary or diaphragm pumps. This reduces the weight, cost and wear and results in simplicity of construction. Mr. W. H. Hoover and Mr. A. W. Wasey represent the company.

The Federal Electric Company is making an exhibition of its signs and various types of tungsten clusters. A sample board of specialties, a "Dim-a-lite" demonstration, a small model of a ground plate installation and a vacuum-cleaner outfit complete the exhibit. The corps of attendants include Messrs. J. M. Gilchrist, H. E. Brinckerhoff and J. J. Magee.

The Fibre Conduit Company is represented by Mr. J. M. Nelson, Jr., and Mr. F. A. Curtis, both of whom demonstrate how much easier and quicker the product of their company can be placed underground than the average conduit. Samples of fiber underground conduit and fittings occupy the booth maintained by the company.

Fort Wayne Electric Works show the different forms of alternating-current meters for service and switchboard use, two shunt and one series transformer used in connection with switchboard instruments, a calibrator used for calibrating meters in service, a special meter-testing board, pedestal commutator truing devices for turning down commutators without removing them from the machine, standard transformers and a number of motors. The small motors range in size from 1/100 hp to 1/6 hp and the larger motors are rated at 3 hp and 5 hp. One of each of the standard lines of fan motors built by the company is also on exhibition. The Compensarc, which is a special auto-transformer device for use with moving-picture machine arc lamps, together with a special switchboard for operating the device and showing relative comparisons, is featured. A full supply of all the company's literature describing the apparatus on exhibition is also available. The exhibit is in charge of Mr. A. A. Serva, assisted by the following: Messrs. F. S. Hunting, J. C. Lott, T. L. Sturgeon, H. W. Smith, C. A. Woolsey, E. H. Porter, J. B. Mills and T. W. Behan.

Fraley Hand Vibrator Company's exhibit in the side aisle is presided over by Mr. Charles M. Schunck. The vibrator is used extensively in barber shops and although operated electrically the actual massage movements are imparted to the hand through a flexible shaft.

General Compressed Air Vacuum Machine Company has one of its portable cleaners in operation. The company is represented by Mr. A. R. Thomas, who points out the advantages of the steel dust-separating tank, positive-pressure rotary pump, which is driven by a ¼-hp motor and the general advantages of vacuum-cleaning apparatus.

The General Electric Company's exhibit is located in the middle of the exhibition hall on the south side. Here are shown a collection of tungsten lamps of various sizes, some of the newer designs of heating and other devices, including the new "Calorite" heat unit flatiron, the radiant toaster, etc. The company is showing various arc lamps, some of which are new to central-station men in general. These include a series of magnetite arcs, carbide lamps, flame arcs, and a new small-sized intensive flame arc. A collection of instruments of special interest to central-station men, and transformers showing the three different stages in transformer development, are features attracting attention. The oscillating electric fans and the standard series tungsten outfits are also shown. As usual, a large representation from all parts of the country is present. Among them are the following: Messrs. C. D. Haskins, D. R. Bullm, P. D. Wagoner, F. G. Vaughen, A. D. Page, E. E. Gilbert, C. W. Stone, T. Beran, E. D. Mullen, F. N. Boyer, T. P. Bailey, F. H. Gale, F. W. Wilcox, W. H. Coleman, A. D. Bobson, H. C. Houck, J. Scribner, H. C. Glaze, G. L. Thompson, C. B. Burleigh and H. J. Buddy.

General Vehicle Company features one of its two-ton standard chasses, which is jacked up so that the motor can be run to demonstrate the operation. One of its 2000-lb. wagons recently furnished to the Atlantic City Electric Light Company is also shown. The company is officially represented by Messrs. Day Baker, J. H. Vail, J. H. Hanson and R. McA. Lloyd.

G. M. Gest, whose specialty is underground construction work, shows besides the various materials used in this work, the Gest patented cable rack and hanger and the reinforced pole of the New York Pole Company. Mr. H. H. Stannard is in charge of the booth.

The Griscom-Spencer Company sent three of its representatives to the convention. These are Messrs. J. B. Spencer, Michaelis and Jarvis. Reilly multicoil feed-water heaters,

Reilly grease extractors and Reilly evaporators are the products which the company feels that central-station men are most interested in.

The H. W. Johns-Manville Company exhibits a complete line of "Noark" fuse and service boxes with interchangeable conduit fittings and entrance hoods. Aside from a number of these boxes, which are assembled with fittings, there is a large service box mechanically operated by an induction motor to show the working of the device. Two 13,200-volt fused switches designed for the protection of transmission lines are exhibited for the first time. The switches are designed to be installed on poles without housing of any kind, the fuses being protected from the elements in a novel manner. A feature of the exhibit is the interchangeable service meter-sealing system, which provides for the installation of any number of meters feeding from a single service which in turn is protected by a service box. Only seven parts are required to make an installation using any one of the four more prominent makes of alternating- and direct-current meters. Theft of energy is prevented and a neat appearing job is obtained in addition. As usual a complete line of fuses and cut-out blocks are shown, a feature being that the line has been extended to 1000 amp. A variety of subway boxes and special fuse devices are on view. Specimens of "Linolite" tubular lighting with both carbon and tungsten filaments, reflectors for show-window, show-case and picture lighting, weatherproof outlining material, a variety of desk and table lamps, Victor combination meters, porcelain high-voltage insulators, asbestos wood for busbar compartments, guy anchors, friction tape, strain insulators, splicing compounds and a variety of other fireproof and insulating materials of interest to central-station men are in evidence. Those present are: Messrs. J. W. Perry, T. L. Barnes, H. M. Frantz, G. A. Saylor, H. M. Voorhis, S. G. Meek, R. C. Cole and R. C. Buell.

Metropolitan Engineering Company has an elaborate display of its meter protection devices manufactured under the Murray patents. The booth is in charge of Mr. R. M. Mann, who, with numerous assistants, explained the features of the porcelain specialties on exhibition which have called forth much favorable comment. Reflector-type signs, utilizing tungsten lamps, are also part of the exhibit.

Minerallac Company is represented by Mr. Frank Kinney and in its booth is displayed the Chicago printing attachment, which may be attached to a watt-hour meter and which prints the amount of energy consumed during intervals of 15, 30 or 60 minutes. Other of the company's products, such as Minerallac insulating compounds, voltmeter switches, reverse current relays, speed limit devices, electroscopes and emergency outfits, are also on exhibition.

National Carbon Company is not an exhibitor this year, but is represented by a large delegation. This is composed of Messrs. D. D. Dickey, A. N. Barron, J. S. Crider, N. C. Cotabish, J. F. Kerlin, F. C. Park, A E. Carrier, C. W. Wilkins, M. W. Allen and W. T. Conn.

National Electric Lamp Association, through its engineering department, has designed its booth so as to show the various types of incandescent lamps manufactured by the member companies. Surrounding the booth on four sides is an arch construction from which is built a dome completely studded with small low-voltage sign lamps and suspended from these arches are several types of tungsten regular Meridian type lamps equipped with prismatic reflectors. The interior of the booth is furnished in a uniform style adapted to the exhibition cases, tables and furniture. The separate exhibits show the processes of manufacture of tungsten lamps from the crude ore to the finished lamp and the exhibition cases and tables demonstrate the many uses of the tungsten lamp and its greater efficiency. The several types and sizes of series and multiple lamps for street lighting are exhibited on a rack. A large case contains an exhibition of all standard Gem, tantalum and tungsten lamps, and many regular, special types of carbon, tantalum, tungsten miniature train lighting and automobile lamps, the latter in their proper reflectors, for several classes of service. Those in charge of the exhibit are: Messrs. P. F. Baader, R. F. Strickland and G. S. Merrill.

The Nernst Lamp Company displays a complete line of its new lamps. Of considerable interest is the new spring type of holder, the design of which makes it applicable to lamps of the old type. This holder makes the mounting of glowers automatically correct, so that glowers may be renewed by common help not having the slightest experience in electrical work. Exhibited for the first time is the new single-glower lamp, a universal cluster, ornamental multiple-glower lamps and universal chandeliers of various types. The representatives present are: Messrs. W. D. Uptegraff, Max Harris, C. A. Barton, G. F. Hom, J. H. Gardiner, J. B. Mitchell, O. Foell, A. L. Eustice, J. O. Little and S. P. Wilbur.

Novelty Incandescent Lamp Company has an assortment of incandescent lamps which is very interesting. There is a full line of carbon filament, regular tungsten and any-position tungsten lamps shown by Mr. R. K. Mickey, the president of the company, who has charge of the display.

Pettingell-Andrews Company shows a full line of P-M specialties, including the devices for the protection and control of services, remote control switches, meter connection blocks, fuse block covers, ground clamps and reflectors. Forming part of the exhibit are also fuses, wires, street fixtures, insulators, glassware, tungsten lamps, tungstometers and meter seals. Messrs. F. S. Price, W. J. Keenan and G. E. Palmer are in attendance.

Philadelphia Electrical & Manufacturing Company's exhibit comprises some interesting line material. A new and complete set of tungsten street-lighting fixtures is shown, and

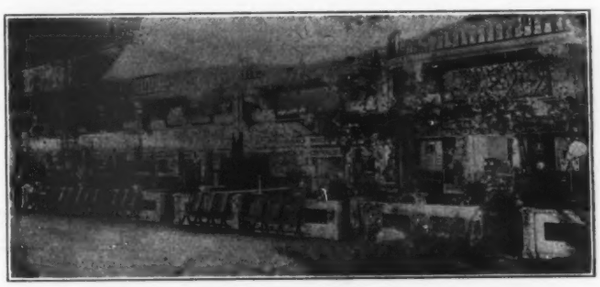


FIG. 4.—VIEW OF SOME OF THE EXHIBITS.

worthy of note is a line of ornamental brackets as well as hoods and casings to be used with single lamps and clusters so as to give them the appearance of being arc lamps instead of incandescent lamps. An absolute cut-out of merit, as well as fuse boxes and malleable line material of all kinds, embracing many ideas not heretofore shown, are also part of the exhibit, which is presided over by Messrs. C. L. Bundy and W. O. Dale.

Phoenix Glass Company has two representatives at the convention, Messrs. A. H. Patterson and E. H. Peck. The company has brought out a new line of glassware for tungsten lamps which has met with wide approval and the company's representatives say that both factories are kept busy turning out the new product.

Pittsburgh Reinforcing Pole Company is represented by Messrs. R. S. Orr, William A. Donkin and W. A. McCombs. The company's exhibit consists of samples showing the practical application of its reinforcing process. The butt of a pole used on the lines of the Allegheny County Light Company for about 15 years has the decayed portion of the wood cut away, making the butt somewhat like an hour glass in appearance. Reinforcing rods of ½-in. steel, pointed at both ends, are employed; the rod being driven into the sound portion of the butt remaining and spanning the decayed section. The upper end of the rod comes to a point about 12 in. above ground and after all the rods are in position the whole is encased in concrete. The butt of a reinforced pole, which was in service some months, is shown cut in section for the purpose of exhibiting the strength and lasting qualities of a reinforced pole. It is estimated that

the life of a pole can be prolonged 10 years by this means. The appearance of a reinforced pole above ground with its collar of concrete extending about 16 in. above ground and tapering from 3 in. to 1½ in. is shown by actual example.

The Price-McKinlock Company exhibits a line of its specialties including devices for the protection and control of consumers' circuits, remote-control switches, meter connection blocks, fuse-block covers, ground clamps, reflectors and lighting fixtures. Messrs. F. S. Price and G. E. Palmer are in attendance.

Pittsburgh Transformer Company's exhibit consists of the various transformers built by the company. The exhibit is mainly devoted to the display of the new line of transformers which is characterized by high efficiency and rugged construction. The new distribution transformers are made in all commercial sizes from 0.6 kva to 50 kva and are all of the core type. The company believes that its line is among the very best in mechanical construction and design. The familiar Pittsburgh stogies are in evidence as well as a very attractive edition of the "pretty girls." Engraved invitations have been sent out to friends and customers placing the booth at their convenience. Representing the company are Messrs. F. C. Sutter, H. G. Steele, R. V. Bingay, C. R. Lininger and P. H. Butler.

Rauch & Lang Carriage Company is represented at the convention by an electric coupé, the features of which are explained by Mr. J. Harry Killus. A single handle controls six forward speeds, three reverse speeds, two brakes and a single bell. Besides being fool-proof the control is also thief-proof by the use of a Yale-type key. This must be in the control handle when the car is in motion and before leaving the car it is necessary to remove the key, and thus the car is locked.

The Ricker Manufacturing Company, manufacturer of the Rochester meter and service box, is represented by Mr. George Hearn. The exhibit consists principally of the distribution and control specialties made by the company, among which are oil fuse boxes, meter and service boxes, cable junction boxes, divided service boxes and meter loading devices.

John A. Roebling's Sons Company makes its headquarters at booth No. 40, where samples and printed matter illustrating flexible heater cord, fireproof cable for moving-picture machines and brush cable are distributed. Those present include Messrs. W. P. Bowman, G. W. Swan, F. W. Harrington, W. L. Doyle, J. G. Lee and A. V. Errickson.

Sangamo Electric Company exhibits its various types of alternating-current and direct-current watt-hour meters and makes a special feature of its ampere-hour meter for automobile and storage-battery work. Some of the meters are shown in operation as well as various auxiliaries such as current shunts, series transformers, etc. The company is represented by Mr. R. C. Lanphier, who is assisted by Messrs. J. Bunn and Mr. Chapman in explaining the merits of the Sangamo line.

Simplex Electric Heating Company is represented at the convention by Messrs. J. I. Ayer, E. B. Stebbins, R. P. Ingalls and Roger Williams. There is scarcely a heating device of any importance which is not included in this company's exhibit. Prominent are three sizes of ranges representing the latest development in the electric heating line, and it is now possible to supply from stock ranges capable of cooking for 6 to 50 people. One of the advantages of these ranges is that the utensils, which are made of heavy copper, nickel-plated, are removable from the stoves, thereby permitting them to be properly cleaned and washed. All the wires are covered and out of sight so that should a pot spill over there is no danger of short-circuit. The heater in the oven is arranged on hinges so that it can be raised and the bottom of the oven cleaned. A heater to go alongside the kitchen boiler for hot-water supply is also on exhibition. A combination dining-room outfit, consisting of an electric stove, chafing dish, coffee percolator, teakettle and saucepan, arranged to clamp to the electric stove, is featured. The heating devices shown include heating pads, waffle irons, sealing-wax pots, griddles, teakettles, saucepans, radiators, coffee percolators, curling-iron heaters, glue pots, broilers, milk warmers, double boilers, blazers, foot warmers, soldering irons, water cups, sterilizers, three different sizes of chafing dishes, food warmers, household irons and commercial irons. A cord support or suspension arm to hold up the cord of flatirons and a regulator stand arranged to prevent the iron from becoming too hot when set on a stand are among the company's products. The iron, regulator stand and cord support are all wired together with a signal lamp to show when the iron is in circuit. A photograph of a factory in which 200 of these outfits are installed is in evidence.

The Southern Exchange Company is represented at the convention by Messrs. E. G. Chamberlain and W. E. Mitchell. This company makes a specialty of poles, cross-arms, railroad ties and lumber, and its exhibit is particularly emphasized by the sawed pole, octagonal and square, and the high-grade cross-arms of all standard dimensions. Large photographs of the mills and yards in the South are on exhibition, as well as sections of the octagonal and square pole and the round Southern white cedar.

The Spencer Turbine Cleaner Company displays a 5-hp, vertical, direct-driven, two-sweeper outfit for demonstrating purposes. The avidity with which dirt, nails, waste, cigar-stumps, etc., is taken up by this outfit is wonderful and the ease with which the tools are worked and the manner in which they adapt themselves to corners and angles have been the subject of much favorable comment. The company is represented by Messrs. E. W. Muzzy, R. B. Smith, G. H. Noble and S. W. Bowerman.

Standard Electric Accumulator Company of New Jersey is making a demonstrative exhibit of different sizes of batteries from 10 amp to 200 amp to show how the parts are assembled. A battery of 23 cells, which the company is putting out to operate elapse time machines, is on exhibition and a special pamphlet explains all its advantages. Different parts of the battery elements, sparking sets and automobile elements, and a number of charged cells, complete the display, which is in charge of Messrs C. DeWaal and J. J. Shaughnessy.

Standard Underground Cable Company is represented by Messrs. F. G. Cosby, J. R. Wiley, C. J. Marsh, H. P. Kimball, T. E. Hughes, W. H. Marsh and C. W. Davis. The company is showing for the first time and in a comprehensive way samples of quite a number of the very complete line of lead-covered cable terminals for indoor and outdoor use, and cable junction boxes for use in manholes with single conductor and multi-conductor lead-covered cable. A sample of one of the same type of junction boxes which the company has furnished quite extensively in Central and South America for use with steel-tape armored cable laid directly in the ground instead of in ducts as ordinarily, is also on exhibition. Features of interest are samples of special types of cable as well as sections of joints made with the special insulating tubes which have made the jointing of high-tension cables a matter of certainty and simplicity.

The Star Electrical Concern has on exhibition a very neat switchboard from which two Star flame-arc lamps are suspended. The lamp is 1⅝ in. in diameter and 8 in. high and is equipped with a prismatic reflector. The lamp base is of the standard Edison type, allowing it to be screwed into the ordinary receptacle. Mr. W. H. Gardiner, the inventor of the lamp, is in attendance and Mr. A. W. Young is in charge of the booth.

Stave Electrical Company is exhibiting its line of flaming arc lamps, the features of which are already very widely known to electrical readers. Mr. Batterman is representing the company at the convention and demonstrating the lamps.

Studebaker Company's exhibit is devoted to the display of pleasure and commercial vehicles. A victoria phaeton with more than enough mileage to meet any conditions that an electric vehicle is called upon to meet and in which nothing appears to be spared in the direction of comfort is shown and in another part of the hall is a combination passenger and merchandise-carrying vehicle mounted on the commercial-type running gear and designed to carry a normal load of from 1500 lb. to 2000 lb. The battery on the latter vehicle is suspended on

supplementary springs within its compartment. The running gear is conceded to exemplify the highest development of commercial vehicle design.

C. J. Toerring Company is exhibiting enclosed arc lamps of standard designs, a diffused inverted arc-lighting system and flaming-arc lamps. The company's standard direct-current lamps possess the special feature of long carbon life and high efficiency. Tests made several years ago show the lamp to possess a maximum candle-power of 700, which is rather high for an enclosed-arc lamp consuming so little current. The inverted type of enclosed-arc lamps is unique and is finding a wide application for lighting offices, draughting rooms, color-printing establishments and textile mills. The lamp gives an evenly diffused, white light very restful to the eye and preserving daylight color values. The flaming-arc lamp is fitted with two sets of carbons, thus reducing the labor of trimming one-half and inasmuch as the carbon ends are entirely consumed increased economy in carbon consumption is assured. The company also expects to have on exhibition before the close of the convention a Richardson electric blue printing machine which it has lately begun to manufacture.

The Tungstolier Company centers its display around the folding tungstolier. A mechanical device raises and lowers the arms automatically and serves to attract attention to the fixture. The following gentlemen are present: Messrs. E. J. Kulas, R. B. Basham, H. L. Parker and M. Hartman.

The United States Light & Heating Company is exhibiting battery material, consisting of sample plates for central-station use, vehicle battery plates, sparkers, etc. This company absorbed three companies, including the National Battery Company, and its exhibit is for central-station men primarily. The representatives of the company present include Messrs. C. C. Bradford, Bertram Smith, John A. White and J. Allan Smith.

United Water Improvement Company shows how water may be ozonized and rendered immune from disease-bearing germs. A silent discharge is used in producing the ozone and the apparatus being in operation attracts a great deal of attention. Messrs. Fred Mauer and A. Lohman look after the company's interests.

Wagner Electric Manufacturing Company, besides showing its well-known single-phase and polyphase motors, exhibits an operating model of the single-phase centrifugal device. This is so mounted with commutator, shaft and bearings, but without rotor or stator spider and windings, that by connecting it with another operating motor, its action can be observed. In the booth is exhibited a "moralometer," a direct-reading instrument indicating the morals of an individual. Not a little amusement is afforded by this device. The Wagner delegation includes Messrs. F. N. Jewett, W. A. Layman, W. Robbins, E. W. Goldschmidt, J. Mustard, B. Faxon, D. Emerson, E. H. Cheney, A. Collyer, R. D. Lillibridge and Miss J. A. Nelson.

The Waverley Company, manufacturer of electric carriages, delivery wagons and trucks, makes as the principal feature of its exhibit a mounted driving system. A number of photographs of various models is also shown, but no cars. The absence of these is more than offset by the presence of Messrs. H. H. Rice and W. C. Johnson, whose convincing arguments are not to be disputed by central-station men.

Western Electric Company makes an elaborate display of arc lamps, including the Hawthorn flaming-arc lamp, fan motors, small power motors, pole line material, cable, intercommunicating telephones, automobile charging rheostats, transformers and general supplies. The exhibit is located in two booths. The large corps of attendants include Messrs E. W. Rockafellow, O. D. Street, H. R. King, F. M. Dusenberry, M. A. Oberlander, F. D. Killian, R. M. Morris, H. M. Post and Mr. Gorden.

Westinghouse Electric & Manufacturing Company occupy a booth in the center of the exhibition space on the north side. The booth is arranged as a pergola with grape-vine and other decorations. The illumination is carried out with various sizes and types of tungsten lamps, ranging from 5 watts to 250 watts. The new 5-watt, 4-cp tungsten sign lamps, exhibited for the first time at this convention, means a great saving in energy consumption for electric signs, for on account of the physiological effect of their greater intrinsic brilliancy these lamps are said to be as effective in signs as the duller carbon lamps of several times their candle-power. Series tungsten lamps for street lighting are exhibited, with both the paper-cutout and adjuster-socket types of hanger receptacles. Metallized-filament lamps of 40-watt, 50-watt and 80-watt rating are also shown. The display of arc lamps includes a large line of direct- and alternating-current apparatus of series and multiple types, mill-type lamps and metallic-flame, direct-current arc lamps. The Cooper Hewitt Electric Company exhibits its latest mercury-arc lamps in this booth. Westinghouse mercury-rectifier sets are shown for storage-battery and other small direct-current work. Storage batteries and parts are exhibited by the Westinghouse Machine Company. The motor display includes a full line of shunt- and compound-wound, direct-current, and single-, two-, and three-phase, alternating-current apparatus. A small motor-generator set will be used in demonstrating the operation of graphic recording meters, embracing a line of power, current, voltage, frequency and power-factor measuring instruments. Portable and switchboard instruments, circuit-breakers, switches and choke-coils are displayed. The exhibit of electric conveniences includes electric sad-irons of various types, introducing the new, rounded, pressed-steel toe; tailor's goose-irons, new electric toaster-stove, hot plates, glue and chocolate warmers, luminous and non-luminous electric radiators, sewing-machine and fan motors, etc. The Westinghouse men present at the convention include the following: Messrs. W. M. McFarland, C. S. Cook, C. B. Humphrey, G. B. Griffin, H. P. Davis, Geo. W. Bates, Chas. Wahn, Samuel Chase, M. C. Rypinski, W. P. Jend, W. B. Wilkinson, John D. Mickle, W. Clegg, Jr., R. D. Nye, C. R. Gilliland, J. W. Busch, W. P. Pinckard, Lane Schofield and E. C. Means. Representing the Westinghouse Lamp Company are Walter Cary and T. G. Whaling, and the Westinghouse Machine Company's staff includes Messrs. E. H. Sniffin, L. L. Brinsmade, Wm. G. Davis, H. P. Childs, H. H. Van Blarcom, W. H. Worgorhorst, C. C. Chapelle and D. C. Arlington.

Woods Motor Vehicle Company has on exhibition a coupé and victoria, together with a unit motor frame showing the working mechanism of the Woods electrics. Messrs. F. J. Newman, Walter S. Cramner and J. C. Bartlett are in attendance. The booth is in charge of Mr. Carl J. Metzger.

Yawman & Erbe Manufacturing Company is featuring typical central station record filing systems. These include correspondence filing, purchasing records, card ledger, general index, card record of employees, card record of prospective customers, filing of bills and a motor-driven copier. Mr. Edward S. Babcox is in charge of the booth.

Among other companies represented at the convention but making no exhibits are the following: Okonite Company, Messrs. George T. Manson and Romaine Mace; Central Electric Company, Mr. H. W. Young; Rumsey Electric Company, Messrs. L. J. Costa and G. A. Rumsey; D & W Fuse Company, Messrs. W. S. Sisson and H. F. MacGuyer; Jandus Electric Company, Messrs. A. J. Mitchell and L. J. Costa; Power & Mining Machinery Company, Mr. F. P. Thorp; National Conduit & Cable Company, Mr. H. F. Tate; Excello Arc Lamp Company, Messrs. G. W. Armstrong and A. J. Thompson; Bryan-Marsh Company, Mr. A. W. Marcan; Watson Machine Company, Mr. T. A. Acton; Excess Indicator Company, Mr. A. F. Hallcook; Standard Paint Company, Mr. J. G. Sobberthwait; Gould Storage Battery Company, Mr. H. N. Powers; Franklin Electric Company, Mr. B. F. Ott; Atlantic Insulated Wire & Cable Company, Mr. G. F. Porter; Homer Commutator Company, Mr. F. J. Baird; Pacific Electric Heating Company, Mr. H. F. Holland; Gregory Electric Company, Mr. A. O. Kuehmsted; Stuart-Howland Company, Mr. O. H. Perkins; The Ansonia Electrical Company, Mr. W. J. Tonkin; Warren Electric & Specialty Company, Mr. O. C. Turner; Buckeye Electric Company, Messrs. L. P. Sawyer, J. M. Smith and W. O. Conley; Columbia Incandescent Lamp Company, Messrs. H. M. Cosh, C. Leonard and A. C. Garrison; and Mr. J. H. Hallberg.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The steady improvement in the condition of trade which began about the middle of April continued to be in evidence last week. Reports from all centers show that while there is nothing like a boom in retail trade, the condition is healthy and merchants are not complaining. Among the wholesalers and the jobbers but few orders are being received and these are mostly of a filling-in character. This, however, is to be expected at this season of the year and is in no way discouraging. As a matter of fact, there is on all sides now a sentiment of optimism that cannot be checked by any momentary dulness. The crop situation throughout the West is generally accepted as satisfactory. The weather for the past week has been very much better than earlier in May and in most sections full yields are promised. Of course, it is an accepted fact that the winter wheat crop will be short of that of last year, but even this will not necessarily mean any serious scarcity. In the South the cotton crop is in excellent condition, although it is about two weeks later than usual. Business in this section is in first class shape and the planters are more prosperous than ever before in their history. It is in the iron and steel industries that the greatest improvement has been shown. Excepting in the matter of steel rails all branches of the industry are busy. This is especially true of the wire and structural material trade. In the latter the reduced prices have induced a vast amount of new building to be projected. With money cheap, material cheap and labor costing less than it did a few years ago there has been every inducement to invest. The result of this activity has been to fill up the mills with orders so that almost all of them are running full time. This resumption of business is reflected in the railroad earnings and with the re-employment of labor the retailers will soon be making better reports. The gain in bank clearances is another barometer which shows the expansion of business. The gain for New York last week was 12.5 per cent and for the country outside of the city 16.1 per cent. Collections, while not as good as many merchants could wish, have been gradually improving and business troubles are unimportant. Failures for the week, which ended May 27, were 205, against 219 the previous week, 263 in 1908, 142 in 1907, 127 in 1906 and 154 in 1905.

THE COPPER MARKET.

Prices for copper have advanced during the past week from one-quarter to one-half cent per pound. This was more marked in regard to electrolytic than to lake, with the result that at the close of business on May 28 the two coppers were selling at about the same figure. The takings have been unusually heavy, although it is doubtful if the actual melting has very much increased. It was figured at the close of the month that the deliveries into domestic consumption during May were in the neighborhood of 60,000,000 lb. Deliveries for export during the same month were about 65,000,000 lb. The total production for May will probably not exceed 110,000,000 lb., which shows that the figures of the Copper Producers' Association are certain to record a decrease for the month. It is believed in many places that a large portion of these deliveries are now carried as stocks by the consumers, and that the actual amount of copper in the country is not in keeping with the statistics that will be produced by the association. However this may be, the heavy takings have done a great deal toward putting the market in a much healthier condition than it has been for many months. Prices have been advanced abroad as well as at home, and many consumers now appear to be of the opinion that if they do not get in at the present figures they will have to pay a very much higher rate. One of the largest producers in the country was quoted last week as confidently predicting 15-cent copper before the middle of October, and such a price is not out of the range of probability. The speculative market in London has been particularly active of late. The actual imports and exports for the month of May were very heavy, the former being between 15,000 and 16,000 tons, while exports are estimated at almost 30,000 tons. Quotations on the Metal Exchange May 28 were:

Lake	13⅜ @ 13½
Electrolytic	13⅜ @ 13½
Casting	13 @ 13⅛

The London prices May 28 were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	60 17 6	..
Standard copper, futures	61 13 9	..
Market	Easy	..
Sales of spot		400 tons
Sales of futures		1,300 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

INSULATED WIRE TRADE PICKING UP.—Makers of insulated wire report that their business is daily growing better, and that there are many inquiries being received for future business. Sales are larger than they have been at any time for the past 18 months, and the prospect for future business seems brighter than at any time since the boom days. The manager of one of the largest wire concerns in the country had this to say of the present condition of trade: "We are doing all that can be expected at this time, and from the number of inquiries that are reaching us daily it is very evident that we will soon be rushing with business. The building boom throughout the country has been almost unprecedented, and, if you will notice, a very much greater percentage than usual is for large buildings. The cheap prices for iron and for other fireproof building material has induced investors to go in largely for this grade of construction. All of this building means big business for the wire people. These are the kind of buildings that are always wired, and completely wired. It must be remembered, however, that the wire contracts are the last that will be made for new buildings, and frequently will not be made until the building is almost completed. The heavy trade, therefore, has not yet exactly reached us, but it is not far off. We cannot say what is coming, but I look for an unusually active fall. Wire prices are low in keeping with all other building materials."

CARBON IMPORTERS NOT DISCOURAGED.—The adoption by the Senate of the Smoot amendment to the tariff bill, fixing the duty on lighting carbons at 65 cents per 100 ft., has not entirely discouraged the importers. While they still assert that the imposition of such a rate will practically mean that an importer cannot sell carbons in this country, except the very highest grades, they still believe that this rate will not be finally adopted. "We have received advices from Washington," said one of the importers who has been active in the campaign for a lower tariff, "that there will be a change in the tariff schedule which was adopted last week, either by the Senate itself or when the bill gets into conference. The carbon question has caused a great deal of talk among the legislators, and they are beginning to understand the situation. Carbons, of course, are but a small matter in comparison with the other features of the tariff bill, but central station men throughout the country have been writing their Senators and Representatives to such an extent that an unusual interest has been created in the question. I have every reason to believe that there will be a modification of the 65 cents rate, although I doubt if the final paragraph on carbons will be the 35 per cent ad valorem rate that was adopted by the House. We are not letting any grass grow under our feet, and we are doing everything we can to inform the members of Congress as to the situation."

NEW SUBSTATION FOR THE NEW YORK EDISON.—Plans have been filed for the construction, by the New York Edison Company, of a new three-story substation on Twenty-sixth Street near Sixth Avenue adjoining the present station. The new building will have a frontage of 75 ft. and will cost about $120,000.

EXTENSIONS OF CHICAGO DRAINAGE CANAL HYDRO-ELECTRIC PLANT.—Contracts have been awarded for an additional exciter equipment in the Lockport (Ill.) power house of the Sanitary District on the Chicago Drainage Canal. Bids were asked on this equipment, and the contracts went to the lowest bidder in each case. The waterwheel unit will be supplied by the S. Morgan Smith Company, of York, Pa. It will consist of two twin turbines on one shaft, having a total rating of 600 hp, and will cost $3,850. The generator will be made by the Western Electric Company, Chicago, and will be a 350-kw, 250-volt, 300-revolution, direct-current machine costing $4,265. The W. A. Jackson Company, Chicago, has the contract for the switchboard equipment, costing $2,075, which will include the bench board, remote-control switches and operating instruments for the new unit. Mr. E. B. Ellicott, electrical engineer for the Sanitary District, is issuing specifications for 17 hydraulic jacks for operating the head gates at Lockport, and also for a four-pier, lead-covered, paper-insulated, underground telephone cable to connect the power house at Lockport with the Western Avenue terminal station in Chicago. This cable will be 30 miles long, and when it is in service it will obviate any danger to communication between Chicago and the power house during storms, when telephone service is most needed. Bids for the hydraulic jacks and the telephone cable will be received on June 9.

HILL-HUPFEL ENGINEERING COMPANY.—The Hill-Hupfel Engineering Company has been incorporated under the laws of the State of New York with $200,000 capital stock. The firm will take over the business of Halbert P. Hill and do a general engineering business, specializing on producer gas plants in conjunction with electrical installation. After October it will manufacture a full line of producers for power plants, using bituminous coal, peat or lignite. The corporation is formed for the purpose of manufacturing Hill automatic gas producers, Hill rotary gas-washers and Hill steam turbines. The active members of the firm will be Halbert P. Hill, now in the consulting engineering business, and Otto G. Hupfel, of A. Hupfel Sons Brewery & Company.

WENTWORTH-DEAN ELECTRICAL COMPANY.—Wentworth & Dean, of 211 West High Street, Lima, O., have incorporated their business as the Wentworth-Dean Electric Company, with a capital stock of $10,000. The company will deal in electrical supplies of all kinds and do a general electrical contracting business as well as the manufacturing of fixtures and controlling devices for street railways. The repairing of motors and dynamos will also be a feature of the company's business. The officers of the company are: President, E. A. Dean; vice-president, E. H. Wentworth; secretary and treasurer, Walter O. Dean.

BOSTON INDEPENDENT TELEPHONE LOSES FRANCHISE.—The Supreme Court of Massachusetts has decided that the Board of Aldermen of Boston exceeded its powers when it granted a permit in 1906 to the Metropolitan Home Telephone Company to open the streets of the city and lay conduits. It is held that the abutting property holders should have been notified and should have been given an opportunity to be heard and that without this the permit was worthless. The superintendent of streets had refused to issue a permit and the suit was brought by the telephone company to compel him to act in accordance with the franchise granted by the Aldermen.

GENERAL ELECTRIC BUSINESS GROWING.—Latest reports from the General Electric Company are to the effect that the company's business is now running at the rate of $53,000,000 per year, which is an improvement of 26 per cent over the business done in the fiscal year ended Jan. 31, 1909. All of the plants of the company are well employed, especially the lamp works and the establishment at Lynn. This plant is now employing 8,000 men as against 5,000 at the low point and 10,000 during the boom of 1907. The weekly payroll is now $105,000 compared to $130,000 at the high point. During the time of utmost depression the weekly payroll was only $60,000.

WESTERN ELECTRIC COMPANY'S BUSINESS.—The returns for April made by the Western Electric Company show that business was slightly better than it was during March, and very much better than it was during April, 1908. Sales to the Bell companies have been very much better than for a long time past, and telephone companies are also good buyers of copper wire and other material. There has been considerable development in the installation of moderate-size motors and generators in small manufacturing concerns. It is stated that wherever energy can be cheaply purchased industrial concerns are giving up the use of steam.

HICKORY (N. C.) WATER POWER ELECTRIC COMPANY.—Colonel M. E. Thornton, president of the Water Power Electric Company, of Hickory, N. C., announces that plans are being made to establish a large cotton mill in Hickory, just as soon as the hydro-electric plant in which he is interested is ready to deliver power. If this mill is constructed at Hickory it will obviate and probably prevent the building of a line for the transmission of power to Senoir and Morgantown. The Hickory industries will then use all the power developed.

ELECTRICAL APPARATUS FOR THE PANAMA CANAL.—Bids have been asked, by the purchasing officer of the Isthmian Canal Commission, to be opened June 14 in Washington, for the following supplies: A centrifugal pump and engine, motor car, gasoline motors, transformers, motor-driven trolley and electric hoist. The transformers asked for are 2 of 20-kw capacity, 5 of 15 kw, 20 of 10 kw, 3 of 7½ kw, 20 of 5 kw, 7 of 3 kw, 5 of 2 kw and 5 of 1 kw. The electric hoist is to be for two tons, operated by 110-volt direct current.

COLONIAL ELECTRICAL AGENCY.—The Colonial Electrical Agency Company, 576 Mission Street, San Francisco, is to become incorporated. The firm represents in the territory west of Denver the Colonial Company and the Economy Electric Company, of Warren, O.; Keystone Fibre Company, of Chester, Pa., and Massachusetts Chemical Company, of Walpole, Mass. The firm intends to take on additional electrical lines.

NEVADA-CALIFORNIA POWER COMPANY.—Work on the transmission lines of the Nevada-California Power Company in the Tonopah mining district is progressing very satisfactorily. The electrical apparatus has been delivered, and will be installed within a few weeks. The company is putting in three 350-kw generators at the Manhattan plant. Other units will be installed later on.

Financial Intelligence.

THE WEEK IN WALL STREET.

For the short week, which ended May 28, there was very little trading on the stock exchange. This was largely due to the fact that the market is almost exclusively in the hands of the professionals and this class of traders objects seriously to carrying commitments over an extended holiday. The general tone of the market, however, was strong and there were several developments during the week which tended to stimulate the feeling of buoyancy. Probably the most important of these was the apparent settlement of the long standing antagonism between the Hill and the Harriman railroad interests in the North-

NEW YORK.

	May 24.	May 28.	Shares sold.		May 24.	May 28.	Shares sold.
All-Ch.	16	16	2,040	Int.-Met., pf.	44⅜	46	16,550
All. Ch. pfd..	52	52¼	4,200	Mackay Cos..	79¼	79¼	2,500
Amal. Cop...	83¾	85¼	117.950	M'c'ky Cs.,p..	73½*	73⅞	600
Am. D. T...	29*	29*	———	Man. Elev...	147*	147	400
Am. Loc....	57⅝	58⅞	9,045	Met. St. Ry..	27*	27*	———
Am. Loc. pfd.	115*	115*	10	N.Y.&N.J. Tel.	123*	123*	———
Am. Tel&Cbl.	77¾	77¾*	———	Steel, com..	60¼	64⅜	468,900
Am. T. & T..	138⅞	140⅜	20,126	Steel, pfd...	119¾	120	19,816
B. R. T.....	79	79½	13,303	W. U. T....	—	75¼	2,500
Gen. Elec....	160½*	160¾	1,200	West'h., com.	84	83¾	4,000
Int-Met. com..	16	16½	11,925	West'h., pfd.	121	121	300

PHILADELPHIA.

	May 24.	May 28.	Shares sold.		May 24.	May 28.	Shares sold.
Am. Rys.....	45¾	45¾*	———	Phila. Elec...	12½	12	———
Elec. Co. of A.	12½	12½	———	Phila. R. T..	33⅝	33⅛	———
El. St. B'ty..	48½	48½	———	Phila. Trac...	92½*	92⅜*	———
E.S.B'ty, pfd.	49*	49*	———	Union Trac..	57	56¾*	———

CHICAGO.

	May 24.	May 28.	Shares sold.		May 24.	May 28.	Shares sold.
Chi. City R..	180*	180*	———	Chi. Tel. Co.	132½	133	———
Ch. Rs.,Ser.1.	109½*	109½*	———	Met. El., com.	19*	19*	———
Ch. Rs.,Ser.2.	38¼	38¼*	———	Met. El., p..	—	50*	———
Com. Edison.	119	119½	———	Nat'l Carbon.	86*	87*	———
Chi. Sub'ys..	25⅞*	26	———	Nat. C., pfd..	119*	119*	———

BOSTON.

	May 24.	May 28.	Shares sold.		May 24.	May 28.	Shares sold.
Am. T. & T..	138½	140¼	———	Mex. Tel....	3	3*	———
Cum. Tel....	138*	136*	———	Mex. Tel., pf.	5½*	5½*	———
Edison, E.Ill.	250*	249	———	N. E. Tel...	132⅝	132¾	———
Gen. Elec...	161	161¼	———	W. T. & T...	11½	12	———
Mass. E. Ry.	13½*	12½	———	W. T. & T., p	87	87*	———
Mass E.R., p.	79¼*	69½	———				

*Last price quoted.
Shares sold are for week May 24 to May 28.

west. The agreement of these upon a fair basis for a division of the business assures Wall Street and the railroads that there will be no serious disturbance of rates. Another matter that was satisfactory to the Street was the announcement that the business of the Erie railroad was so greatly improved it would be able to meet all of its financial needs out of its earnings and that at this time it would not be required to issue any of the bonds for which the New York Public Service Commission granted such reluctant permission. The only development of the week, however, which resulted in a distinct advanced movement that could be definitely accounted for, was the announcement that the great iron and steel mills were now bookfull of orders and that full time would be necessary for several months. This condition resulted in the advance of United States steel common to 64⅜, a new high record, while the preferred remained around 120. The dividend report for June amounted to $32,720,119, which was an increase of more than $2,250,000 over the same month last year. This in itself is an indication of that return of prosperity which all traders seem to believe is at hand. The bond market continues to be very strong and the new securities actually sold by the railroads and industrials during the month of May approximate $119,000,000. The total for the five months since the beginning of the year is now in the neighborhood of $635,000,0000. All of these securities have been quickly absorbed and the majority of the offerings have been over-subscribed. The financial condition both at home and abroad seems to be thoroughly satisfactory. While there have been fairly heavy shipments of gold, the banks continue to be overstocked with money. Rates on May 28 were call, 1½ and 2½ per cent, 90-day, 2¾ per cent. The figures in the table are those of the close May 28.

DIVIDENDS.

Blackstone Valley Gas & Electric Company, preferred, quarterly, 1½ per cent, payable June 1.

Mackay Companies, common and preferred, quarterly, 1 per cent each, payable June 1.

Massachusetts Electric Companies, preferred, semi-anual, 1½ per cent, payable July 1.

STANISLAUS ELECTRIC POWER COMPANY.—The purchase of the property of the Stanislaus Electric Power Company, at the recent foreclosure sale, by the United Railways Investment Company, has been ratified, and the new company will at once take over the property. This is the conclusion of negotiations which have been pending for 15 months, and which have been frequently outlined in these columns. The new contract contemplates the issuance of first mortgage bonds on the property, which will take precedence over the original bonds; but it is held that the additional market for power and the improvements that will be made will advance rather than diminish the securities of the present bond issue. For the equities in the preferred and common stock of the power company the underwriters will receive $900,000 of preferred and $900,000 of common stock of the United Railways Investment Company. From the proceeds of the sale of the bonds it is contemplated that the fourth, 10,000 hp, unit will be installed at the Stanislaus power station; the storage dam at Relief Creek will be completed; the steam turbine plant of 5000 kw now under construction by the San Francisco Railway & Power Company at the North Beech power station will be purchased and the installation of an additional steam turbine plant of 9000 kw in the same station will be made. In addition, there will be the acquisition and construction of the necessary distributing lines, including the construction of two 100,000-volt, steel tower, transmission lines from Stanislaus to San Francisco. It is estimated that there can be developed by the Stanislaus property 60,000 hp and that the mines in that section will be willing to pay $60 per hp per annum for the energy. The contract made between the power company and the railroad company provides for a rate of about $30 per hp, and the railroad company expects to use about 25,000 hp. If these calculations are accurate, there should be left 35,000 hp for sale. The projectors of the enterprise claim that there will be a gross return from the railroad company of $750,000 per year, and that the operating expenses will not be more than $200,000, leaving $550,000 net revenue, in addition to what the company is able to sell to outsiders. Altogether, the interests behind the United Railways Investment Company are of the opinion that that concern has made an excellent bargain.

CAPITALIZATION OF INDEPENDENT TELEPHONE COMPANY.—The investigation into the affairs of the United States Independent Telephone Company, in the suit brought by Charles M. Lane at Rochester, disclosed what appeared to be a remarkable state of overcapitalization. The testimony developed that two companies—the United States Independent and the New York Independent Telephone Company—were formed, each having a capital of $50,000,000, and that the only apparent assets of the two concerns were a manufacturing plant in Chicago capitalized at $50,000 and a burglar alarm franchise in New York City valued at $5,000. It was also shown that large blocks of stock were either given away or sold for nominal sums to persons supposed to have political influence. It came out in the testimony that W. J. Conners, chairman of the Democratic State Committee of New York, held a block of $2,000,000 of stock in the United States Company for which he was charged on the books $200,000, but for which it appeared he had never paid. It was also shown that some of the subsidiary companies borrowed money to pay dividends and then increased their capital stock, from the proceeds of which they paid back the loans. The suit was brought by a dissatisfied stockholder who had paid in $4,000.

WESTERN UNION TO GET SIX MILLION DOLLARS.—The United States Circuit Court has finally decided in favor of the Western Union Telegraph Company, that it shall receive $6,000,000 on its judgment against the American Telephone & Telegraph Company. This litigation, which has lasted for about 30 years, was brought to require the telephone company to settle under an agreement by which the Western Union alleged that the telephone concern agreed to account for 20 per cent of all rentals and royalties received from licenses or leases for speaking telephones. The amount was fixed by a special master, Everett W. Burdett, of Boston, who, after extended hearings, settled the basis of royalties. The defendants claim that the award is excessive and that the case could be settled at any time for $2,000,000, but that the American Telephone & Telegraph refuses to settle. The case will undoubtedly be carried to the United States Supreme Court and may be in litigation for another 10 or 15 years.

MORE TALK OF COPPER CONSOLIDATION.—Rumors continue to be persistent in the financial district that a great copper consolidation is in process of formation. It is said that W. E. Corey, president of the United States Steel Corporation, has taken charge of the preliminary negotiations and this is understood to mean that the same interests expect eventually to control the two principal metal industries. That the copper mines of the country are producing to-day more copper than can be sold even at the low prices recently prevailing and that they were induced to do this on account of the excessively high prices that existed a few years ago are two facts that are used as arguments in favor of a consolidation that will control both prices and output.

PUBLIC SERVICE TELEPHONE COMPANY'S PLANS. An application has been filed with the Empire City Subway Company, which has a monopoly of the tube facilities for low tension wires in New York, for space in the company's conduits, by the Public Service Telephone Company. This is the independent company which proposes to operate under the franchise owned by the Long Acre Light & Power Company. The plans as filed call for the installation of 18 exchanges which will provide for 160,000 automatic telephones. It is given out that the capital stock of the company will soon be increased from $10.000,000 to $25,000,000.

CONNECTICUT RIVER POWER COMPANY.—At a special meeting last week of the stockholders of the Connecticut River Power Company, of Maine, a corporation which owns the stock of the Connecticut River Power Company, of New Hampshire, it was decided to increase the capital stock of the company from $2,500,000 to $3,220,000. This company owns the dam at Vernon, N. H., and the new funds are to be used in making improvements and extensions on the property.

CUMBERLAND TELEPHONE COMPANY INCREASE.—The Cumberland Telephone Company had in service on May 1, 220,115 telephone stations, which is an increase of 12,856 since Jan. 1. It has taken the Cumberland company just about five years to increase the number of its stations from 100,000 to 200,000, which speaks significantly for the telephone development of the country.

HELENA & BUTTE ELECTRIC RAILWAY.—The recent issue of $2,500,000 bonds for the Helena & Butte Electric Railway Company have been underwritten by J. G. White & Company, of New York, and work will be commenced on the road at once. The line will be 75 miles long.

REFINANCING DENVER GAS & ELECTRIC COMPANY.—Plans for refinancing the Denver Gas & Electric Company have been only tentatively made, and no public announcement has yet been given out. It is understood, however, that the present purpose is to form a new company, which will probably be called the Denver Gas & Electric Light Company. The new company will have an authorized bond issue of $25,000,000. The amount of its capital stock has not yet been determined, but it will probably not be much greater than that of the present company, which is $3,500,000. The present company is remarkably successful, and is supplying a growing city which is expected to show a population of 225,000 before the next census. The necessity for refinancing arises from the fact that the bond limit of the present company has been reached, and it is necessary to provide for extensions and improvements to meet the development of the city. It is not expected that the entire new bond issue will be put out at once, only a sufficient number of bonds being used to take up the $7,478,600 of bonds of the present company, and to provide for the immediate necessities in the way of extensions. The balance will be held in the treasury for future use as occasion demands. The present company has been most successfully managed by Henry L. Doherty, its president, and Frank W. Frueauff, general manager. Their policy has been to advertise for business, and to push with all of their vigor the sales of the company, both in gas and electricity. The company now has a surplus of $1,383,321, and the earnings, according to its annual report for the year ending April 30, 1909, were 16.75 per cent on its capital stock. Mr. Frueauff, who was in the city last week, had this to say of the success of his company: "We are very proud of the figures shown in our annual report. The gross earnings for the year were $2,256,840; this compared to $689,063 for the year ending April 30, 1902. We think an increase of over 300 per cent in seven years shows that we have not been asleep. The new power contract which we have recently negotiated with the Central Colorado Power Company will enable us to secure water-power upon satisfactory terms from two sources of supply. It will also probably not be required to make outlays for additions to our electrical generating plants for some years to come."

TOLEDO RAILWAYS & LIGHT FINANCING.—The plans for taking care of the underlying bonds of the Toledo Railways & Light Company, which mature on July 1, have been completed. It has been decided to extend the bonds for a period of 2½ years, or until Jan. 1, 1912, raising the interest rate thereon from 5 to 6 per cent. This plan applies only to the underlying bonds, of which $5,300,000 fall due July 1. The 4 per cent bonds of the company, which mature on the same date, will not be taken up at that time, but will be allowed to run on as at present. The directors of the company have executed a contract with Blair & Company, of New York, for the underwriting of the new issues. The holders of the securities will be requested to deposit them with the bankers and consent to the extension. In the event that any of the holders of the present bonds do not care to consent to the extension, Blair & Company agree to purchase their holdings at par. This amounts, as far as the holder is concerned, to the payment of the bond.

CHICAGO CONSOLIDATED TRACTION FRANCHISES.—It is stated that the new franchises of the Consolidated Traction Company, of Chicago, will be similar to those of the City Railway and the Chicago Railways, and will probably provide for a merger of the underlying companies of the Consolidated with the Chicago Railways Company. The City Council is committed to the policy of one fare for the entire city, and disapproves of any plan that would interfere with the unification of all the local surface lines, which ultimately are expected to be under one management. The receivers of the Consolidated have been authorized to issue certificates to the amount of $740,200 in order to provide for necessary rehabilitation. The company at present operates 127 miles of road within the city, and 57 miles outside of the city, much of which has been badly run down.

ELECTRIC BONDS BECOMING POPULAR.—There is evidence in the financial market of New York that the 5 per cent bonds of light and traction companies in Western cities are growing in popularity. For a long time these securities have been neglected in favor of railway bonds and industrial investments. Out of 13 different issues, about half of them being first lien, which have been sold in the New York market within the past six months, the average price has been about 94 and interest. It is said that the investing public is just awakening to the fact that these bonds are secure, and that at such a price as this are a first-class investment.

COMMONWEALTH EDISON COMPANY.—The recent upward movement in the stock of the Commonwealth Edison Company, of Chicago, it is said, has no other significance than that there has been a considerable amount of investment buying. It is positively announced by the directors that there are no specific deals of any kind pending, and that the advance in the stock is purely a legitimate business development. The earnings of the company are steadily increasing; the number of telephone stations is growing every month, and it is predicted that within the near future the dividend rate will be raised from 6 per cent to 7 per cent.

ANACONDA COPPER COMPANY'S EARNINGS DECREASE.—The full report for the year 1908 shows that the gross receipts of the company were $15,604,000 as against $18,751,000 the year before and $29,968,000 in 1906. While disbursements were smaller the amount left for dividends was less than one-third of that of the previous year. In speaking of the decrease John D. Ryan, president of the company, said that the shutdown in January and February of the past year was largely responsible for the decrease. Practically all of the earnings were accumulated in the last six months of the year.

NEW BRUNSWICK TELEPHONE COMPANY PROSPERS.—The New Brunswick Telephone Company has had a very prosperous year. Reports presented at the annual meeting showed the gross earnings for the past year to be $230,595 and operating expenses $138,514, leaving a balance of $92,080.85. From this the company paid a dividend of 6 per cent, leaving a gross surplus of $33,728. The election of officers resulted as follows: New directors, R. Slipp, Fredericton, and J. M. Robinson, St. John. Alfred Seeley, who resigned as secretary-treasurer, was succeeded by A. W. Macklin.

SOUTHERN POWER COMPANY EXPANDING.—The Chester (S. C.) Power Company has been organized by the Southern Power Company to take charge of the light and power business of that city. The capital stock is $50,000. The Southern Power Company has interests equally as important in many other cities and towns all over the Piedmont section of the Carolinas, all of which are operated directly by the parent company, except that at Chester. Dr. W. Gill Wylie, president of the Southern company, is also president of the Chester company.

UNITED RAILWAYS OF ST. LOUIS LIABLE.—The Court of Appeals in St. Louis has affirmed a judgment for damages against the United Railways Company, which was inherited from the old St. Louis Transit Company. The decision declares that when the new company acquired the assets of the old company it could not avoid acquiring at the same time its obligations. This decision is regarded as a test case and involves damage judgments to the amount of $1,500,000 against the old company. It is said that an appeal will be taken.

INTERNATIONAL SMELTING COMPANY.—It is reported that the International Smelting & Refining Company is planning the erection of a plant in Arizona, or at some point in the Southwest, where Arizona copper ores can be conveniently treated. Representatives of the company have been traveling throughout that mining region advising all mining companies not to make long contracts with any other smelter, as it would probably be but a short time before they would have an opportunity to have their smelting done in competition.

BROOKLYN RAPID TRANSIT.—It is stated that the earnings of the Brooklyn Rapid Transit for the fiscal year, which will end June 30, 1909, will amount to about 5 per cent upon its stock. It is also expected that the company will easily be able to earn this amount in the coming year. There is some talk that the dividend will be raised to 5 per cent next fall, but as yet this seems to be entirely problematical. Reports from the operating department of the road show that business is increasing daily.

DEVELOPMENT AT JACKSON SHOALS, ALA.—The Alabama Power Development Company, financed by the Electric Bond & Share Company, of New York, has had a representative in Anniston, Ala., seeking franchises for the installation of electric service. Power is being developed at Jackson Shoals, and it is proposed to connect Anniston and Talladega with the transmission lines. The local lighting and street railway companies are controlled by the same interests.

INTERBOROUGH RAPID TRANSIT EARNINGS.—The report of the Interborough Rapid Transit Company, made to the Public Service Commission, for the quarter ended March 31, 1909, shows that the gross earnings from the operation of the subway division were $3,321,525, an increase of $459,400 over the same quarter in 1908. The net income for the subway was $1,291,440, an increase of $148,450. On the elevated division the gross earnings for the three months were $3,251,230, an increase of only $28,922. The net income was $282,763, an increase of $97,119. Both of these net results are calculated after the payment of taxes, rentals and other deductions. The report shows that the business of the subway continues to grow more rapidly than that of the elevated.

NEW YORK & HARLEM RAILROAD.—The directors of the New York & Harlem Railroad Company are discussing plans to protect their property, which is now leased to the Metropolitan Company for a rental of $400,000, with a guarantee of the payment of interest charges and taxes. The Metropolitan Company has failed to provide for about $800,000, covering franchise taxes, which are now in litigation, and is also in default in its rental. This company owns 9¼ miles of track on Fourth and Madison Avenues, New York, running from the postoffice to the Harlem River. At the meeting of the directors W. K. Vanderbilt was re-elected president, and all of the old officials were re-elected to the positions they formerly held in the board.

NIAGARA FALLS POWER COMPANY BONDS.—The shareholders of the Niagara Falls Power Company voted on June 1 to authorize a mortgage of $25,000,000 to secure bonds maturing in 1932. These bonds bear a rate of interest not exceeding 6 per cent; a definite rate has not yet been fixed. The proceeds of the issue are to be used to refund $9,000,000 of debentures, and the balance for other corporate purposes, chief among which is the construction on the Canadian side of additional facilities. It is expected that the latter will cost about $4,000,000.

SEEKS THIRD AVENUE SALE POSTPONEMENT.—F. W. Whitridge, receiver of the Third Avenue Railroad, has written to Comptroller Metz asking him to postpone the advertised sale of the Third Avenue Railroad property for nonpayment of franchise taxes which was set for June 5. Mr. Whitridge states that he is making efforts to have the matter settled by compromise, or by some other arrangement that will obviate the necessity of the sale. The mortgage foreclosure sale of the property has been set for next September.

WISCONSIN UTILITY VALUES.—Preliminary values on Wisconsin street railway, light, heat and power concerns aggregate $37,344,000. This figure is likely to be reduced about $2,500,000 when the final estimates are made up. The final estimate last year was $33,932,000. The preliminary value of the Milwaukee Electric Railway & Light Company was $22,000,000 of this sum.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Telephone & Telegraph Company:					
April, 1909	$3,881,767	$161,109	$3,720,658	$592,602	$3,128,055
April, 1908	3,612,424	192,925	3,419,499	648,054	2,771,445
Cape Breton Electric Company, Limited:					
March, 1909	16,462	11,142	5,319	4,065	1,254
March, 1908	17,432	11,433	5,998	4,108	1,890
Dallas Electric Corporation:					
March, 1909	102,666	62,996	39,670	25,584	14,086
March, 1908	87,997	61,758	26,238	25,993	245
Detroit United Railway Company:					
Four months ended April 30, 1909	608,024	374,202	233,822	154,155	91,347
Four months ended April 30, 1908	546,162	350,426	195,737	134,249	66,486
Edison Electric Illuminating Company, Brockton, Mass.:					
March, 1909	20,480	12,270	8,210	2,802	5,407
March, 1908	16,962	8,453	8,508	2,135	6,373
El Paso (Tex.) Electric Company:					
March, 1909	45,602	29,005	16,597	7,911	8,685
March, 1908	43,640	32,567	11,073	7,069	4,003
Galveston-Houston Electric Company:					
March, 1909	95,610	59,075	36,535	18,829	17,705
March, 1908	83,528	51,033	32,505	17,867	14,637
Houghton County (Mich.) Electric Light Company:					
March, 1909	19,771	10,846	8,925	3,499	4,864
March, 1908	18,750	9,715	9,034	3,165	5,869
Houghton County (Mich.) Traction Company:					
March, 1909	25,456	14,905	10,551	5,296	5,254
March, 1908	19,773	12,259	7,514	4,806	2,707
Interborough Rapid Transit Company:					
Quarter ended March 31, 1909	6,842,756	2,723,614	4,481,412	2,907,207	1,574,205
Quarter ended March 31, 1908	6,354,432	2,705,931	3,966,842	2,638,207	1,328,635
Jacksonville (Fla.) Electric Company:					
March, 1909	41,047	23,590	17,456	8,360	9,096
March, 1908	36,965	21,983	14,982	8,397	6,585
Long Island Railroad Company:					
Quarter ended March 31, 1909	1,564,229	1,528,809	35,419	.....	.....
Quarter ended March 31, 1908	1,626,191	1,732,093	*105,902	.....	.....
Lowell (Mass.) Electric Light Corporation:					
March, 1909	28,909	18,472	10,436	3,640	6,796
March, 1908	26,503	15,873	10,629	4,384	6,245
Minneapolis General Electric Company:					
March, 1909	89,039	40,428	48,611	30,134	18,476
March, 1908	83,089	36,466	46,623	31,237	15,386
Northern Texas Electric Company:					
March, 1909	109,013	60,357	48,453	17,173	31,482
March, 1908	91,650	48,403	43,247	14,269	28,978
Paducah (Ky.) Traction & Light Company:					
March, 1909	17,640	10,855	6,785	6,964	*178
March, 1908	18,303	8,975	9,327	6,938	2,389
Pensacola Electric Company:					
March, 1909	19,013	11,549	7,464	4,339	3,124
March, 1908	19,205	13,319	5,885	4,164	1,720
Portland (Me.) Electric Company:					
April, 1909	27,599	10,487	17,112	9,194	7,918
April, 1908	22,442	9,942	12,500	8,798	3,702
Puget Sound Electric Railway Company:					
March, 1909	146,286	103,166	43,413	38,246	6,166
March, 1908	127,448	83,035	44,413	38,246	6,166
Savannah Electric Company:					
March, 1909	46,814	29,215	17,598	15,845	1,753
March, 1908	48,160	35,161	12,998	15,427	2,428
Schenectady Railway Company:					
Quarter ended March 31, 1909	195,821	145,904	49,817	.....	.....
Quarter ended March 31, 1908	192,828	153,381	39,446	.....	.....
Seattle Electric Company:					
March, 1909	420,416	262,078	158,337	89,560	68,777
March, 1908	354,886	214,536	140,350	77,904	62,445
Tampa Electric Company:					
March, 1909	48,176	27,701	20,474	3,858	16,615
March, 1908	43,121	29,233	13,887	2,236	11,650
Toledo Railways & Light Company:					
April, 1909	215,315	122,472	92,843	70,914	22,166
April, 1908	202,317	109,215	93,102	70,702	22,423
Whatcom County (Wash.) Railway & Light Company:					
March, 1909	32,171	18,062	14,109	8,190	5,918
March, 1908	28,561	15,973	12,588	8,017	4,571

* Deficit.

GENERAL NEWS

Construction News.

ANNISTON, ALA.—The Alabama Power Development Company, financed by the Electric Bond & Share Company, of New York, N. Y., has a representative in town seeking franchises for a central station service, current to be taken from Jackson Shoals.

BESSEMER, ALA.—The Republic Iron & Steel Company is reported to be considering the installation of an electric plant at its mines at Raimund.

BIRMINGHAM, ALA.—The Birmingham & Edgewood Electric Company has applied to the City Council for a franchise to construct an electric railway from the southern terminus of the South Highlands line along Twentieth Street to the city limits. The new company proposes to connect this city with Shade's Valley.

HEFLIN, ALA.—Plans are being prepared by J. B. McCrary & Company, of Atlanta, Ga., for the proposed water works and electric light system at Heflin.

PRESCOTT, ARIZ.—The Arizona Overland Telephone Company has purchased the franchise for a telephone and electric system of Robert Brown, M. J. Hickey and H. T. Andrews. It is said that the company will make Prescott the headquarters for a long-distance system in Arizona, New Mexico and California. The system will include a telephone line already in operation from Globe to Jerome and Flagstaff, and a line will be built east to Albuquerque and west to Needles, and eventually to Los Angeles, Cal.

TUCSON, ARIZ.—Preparations are being made by the Consolidated Telephone, Telegraph & Electric Company for extensions and improvements to the telephone lines recently acquired from the Sunset Telephone Company. The plans call for the construction of a new telephone line from Tucson to Yuma, and will connect there with the system of the Pacific Telephone & Telegraph Company. The plans also call for the completion of the extension to Globe and later to Morenci and Clifton in the Graham County mining sections and the agricultural sections of districts in that county. The improvements will include a copper loop line from Benson to Bisbee, and the erection of a new telephone line from Maricopa to Phoenix to connect with the line from Tucson to Yuma. The cost of the entire work is estimated at about $250,000. C. W. Hinchcliffe is general manager.

DELIGHT, ARK.—John W. Hill is reported to be interested in the construction of an electric light plant in Delight.

NETTLETON, ARK.—The St. Louis & Southwestern Telephone Company contemplates installing an exchange at Nettleton.

SEARCY, ARK.—A project is on foot to construct an electric railway from Higginson to Searcy, a distance of four miles; also a street car line in Searcy, which is to be extended from Searcy to Searchlight Park, two miles distant. The company is to be known as the Searchlight Power & Electric Company. According to the present plans, the power house will be located in Searcy. Louis Lorch, of Searcy, is promoting the project.

WHEETLEY, ARK.—The Wheetley Rice Mill & Power Company has awarded the contract for construction of power house and other buildings to Ilsen & Lesh, Memphis, Tenn.

BERKELEY, CAL.—The Pacific Gas & Electric Company is reported to be contemplating the installation of a 1350-hp motor-generator set in its substation at Hearst and Gee streets.

OROVILLE, CAL.—The Blue Lead Mining Company is making plans for extensive additions and improvements to its mine. Electricity will be used for operating the machinery.

SAN FRANCISCO, CAL.—A 15,000-hp steam turbine has recently been installed in the plant of the City Electric Company by the Westinghouse Machine Company, of Pittsburgh, Pa.

SAN FRANCISCO, CAL.—The city lighting committee is making investigations with a view of improving and extending the lighting system. The committee has engaged an engineer to prepare plans for a more uniform method of lighting the streets and will recommend to the Supervisors not only improvements but extensions to the present system.

SAN FRANCISCO, CAL.—Negotiations are under way by the California Gas & Electric Corporation for the purchase of the property of the City Electric Company. It is said that the price is placed at $5,000,000. The City Electric Company operates a large electric plant at North Beach and is controlled by the Fleischhacker-Mack interests. The company furnishes electricity for motors exclusively.

SAN JOSE, CAL.—Captain J. Barneson, representing the United Railroads, has filed a petition with the City Trustees for a franchise to construct and operate an electric railway on certain streets in this city.

SANTA ROSA, CAL.—The Snow Mountain Power Company is extending its transmission lines from Fulton to St. Helena, and plans are being made to extend it to Guerneville.

PUEBLO, COL.—We are informed that the Pueblo Suburban Traction & Lighting Company is preparing to increase the boiler capacity of its power plant by 1000 hp. John F. Vail is general manager.

MIDDLETOWN, CONN.—The Middletown Electric Company contemplates extending its transmission lines to Durham, a distance of six miles. L. C. Whitney is manager.

WASHINGTON, D. C.—Sealed proposals will be received by James Wilson, Secretary of Agriculture, until June 10 for an engine, generator, switchboard, and for labor and materials for use in the extension of the heating system in the buildings of the Weather Bureau at Twenty-fourth and M Streets, in the City of Washington, D. C., in accordance with plans and specifications which may be obtained from the Chief of the U. S. Weather Bureau, Department of Agriculture, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the Commission of District of Columbia, Washington, D. C., until June 10 for furnishing materials and labor for wiring and equipping with electricity and apparatus and making additions, alterations, etc., in Physics Laboratory of the M Street High School in Washington. Blank forms of proposals, specifications and all necessary information may be obtained on application to the property clerk, District Building, Washington, D. C. Henry B. F. MacFarland, Henry L. West and William V. Judson are commissioners.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., for furnishing and installing three motor-generator sets, nine switchboards with necessary accessories, and for wiring, equipping with electricity and making alterations, etc., as specified in the Eastern, Western and Central High Schools in Washington, D. C. Blank forms of proposals, specifications and all necessary information may be obtained on application to the property clerk, District of Columbia, District Building, Washington, D. C. Henry B. F. MacFarland, Henry L. West and W. V. Judson are commissioners.

WASHINGTON, D. C.—Bids will be received until June 8 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards and naval stations the following supplies: Brooklyn, N. Y., or Puget Sound, Wash., Schedule 1244—1450 lb. copper wire and 1650 lb. magnet wire, etc. Brooklyn, N. Y., Schedule 1290—100,000 ft. lighting wire, 31,000 ft. interior communication cable, 700 lb. magnet wire, 23,000 conduit straps, 10,200 insulator hangers. Charleston, S. C., Schedule 1276—Electric deck winch. Philadelphia, Pa., Schedule 1290—Armature blades, etc.; armatures, coils, rheostate, etc. Boston, Mass., Schedule 1290—2500 ft. steel enameled conduit. Applications for proposals should designate the schedule desired by number.

LEESBURG, FLA.—We are informed that the Leesburg Ice Company, of which J. Y. Clark is president, has been granted franchises to install water works system and electric light plant. Arrangements are nearly completed for the construction of the water works, but plans have not yet been prepared for the electric light plant. F. M. Stansbrough, of Leesburg, is engineer.

LA GRANGE, GA.—Improvements and extensions have been made to the municipal electric light plant, which includes the installation of a 200-kw Westinghouse generator, a 20-kw motor generator, exciter set, one 320-hp Erie Ball cross-compound Corliss type engine and a 200-hp Cole return tubular boiler. R. W. Underwood is manager.

WAYCROSS, GA.—At an election to be held June 19 the citizens will vote on the proposition of municipal ownership of electric lighting plant and to issue $36,000 in bonds to pay for same. The question of purchasing the plant of the Waycross Electric Light & Power Company is under consideration.

MOUNTAIN HOME, IDAHO.—The plant of the Mountain Home Electric Company, which has been out of commission for some time owing to the burning out of the dynamo, was sold at a sheriff's sale May 12 to the Hewitt Land Company, for $25,000. It is understood that the new owners will make the necessary repairs as soon as possible and put the plant in operation. The streets have been in darkness and residences and business houses have had to resort to lamps.

SANDPOINT, IDAHO.—Surveys are now being made by the Northern Idaho & Montana Power Company for a transmission line to be erected between Sandpoint and Newport, Wash. Plans are also being made to improve the water power development on the Moyie River and to transmit the power to Sandpoint.

DECATUR, ILL.—The Decatur, Sullivan & Mattoon Transit Company has filed a deed making the Windsor Trust Company, of New York, N. Y., trustee for a bond issue of $2,500,000. The company proposes to construct a railway from Decatur to Mattoon, Ill., 48 miles in length, which, with extensions contemplated, will make a total of 100 miles.

EAST ST. LOUIS, ILL.—Plans are being prepared by the engineering department of the Illinois Traction System for the construction of a new power plant to be erected in East St. Louis, on the lower side of the new Missisippi River bridge, now under construction. The proposed plant will

be the largest of the system and is designed to supply electricity to all the railways of the Illinois Traction System south of Springfield. The plant is to have an output of 10,000 hp, which can be doubled when necessary. Plans will also be made for the new St. Louis station as soon as the site is selected.

MOUNT CARMEL, ILL.—The Mount Carmel Gas & Electric Company has been placed in the hands of a receiver. The company is a newly organized concern and charges the City Council with unfair treatment by revoking its franchise because its plant was not being finished within the prescribed time limit. The company claims that every effort was made to complete the plant and that the work already accomplished represents an expenditure of $100,000 for the installation of gas, electric light and hot water heating systems.

SPRINGFIELD, ILL.—Plans have been prepared for the construction of an electric belt railway to connect all railroads and interurban lines entering the city. The cost of the road is estimated at $200,000. F. B. Martin, of Decatur, engineer of construction of the McKinley lines, will have charge of the work.

TINLEY PARK, ILL.—The capital stock of the Tinley Park Electric Light Company has been increased from $2,500 to $5,000.

BRAZIL, IND.—It is reported that bids will soon be called for the installation of machinery and equipment for the power house being constructed by the Brinkerhoff Piano Company in this city. It is said that plans for the plant are now ready.

ELKHART, IND.—The Indiana & Michigan Electric Company has notified its patrons that after June 20 the price of electricity for commercial lighting will be raised from three to six cents per kw-hour. It is said that the business men contemplate establishing an independent plant.

EVANSVILLE, IND.—The Board of Public Works is asking for bids until June 19, 1909, for the lighting of a portion or all of the streets, public buildings, fire houses and city parks. Bidders will be required to designate the particular streets or buildings and parks they bid on.

INDIANAPOLIS, IND.—The telephone train service put on by the Big Four Railroad between this city and Cincinnati is giving such good satisfaction that the company will next equip the line between this city and St. Louis.

INDIANOLA, IND.—Plans are being considered for making improvements and extensions to the municipal electric light plant, which will include the installation of a generator and Corliss engine. C. C. Litzenberg is superintendent and purchasing agent.

LAFAYETTE, IND.—Trustees of the State Soldiers' Home will receive bids until June 18 for the installation of mechanical stokers for six steam boilers, for a dynamo, engine, switchboard and other equipment. A. C. McCorkle, is chairman of the Board of Trustees.

GRUNDY CENTER, IA.—Plans are being prepared by the Grundy Center Telephone Company for the construction of a new exchange building, to cost between $7,000 and $8,000.

COTTONWOOD FALLS, KAN.—The Home Light & Power Company contemplates the development of a water power and the erection of a transmission line about seven miles in length. W. W. Austin is manager.

LEXINGTON, KY.—The contract for the construction of the proposed electric interurban railway of the Central Kentucky Traction Company, from Lexington to Nicholasville, 12 miles in length, has been awarded to David Pepper, Jr., of Philadelphia, Pa. Swethurst & Allen, engineers and contractors, of Philadelphia, Pa., will do the work. J. B. Crawford, of Lexington, is general manager of the traction company.

LOUISVILLE, KY.—The Louisville Railway Company is planning to construct a new boiler house, which will necessitate the purchase of boilers with a rating of 2000 hp.

MOUNT STERLING, KY.—The Old Kentucky Telephone Company, which recently secured a franchise in Sterling, has commenced work on the installation of a telephone system in this city. The company will install a switchboard costing about $6,000. The plant complete will cost approximately $15,000.

MACHIASPORT, MAINE.—The Machias Canning Company is preparing to light its factory with electricity, generated by its own plant.

ATHOL, MASS.—The Orange Electric Light Company has purchased the plant and holdings of the Athol Gas & Electric Company. Extensive improvements and changes are contemplated by the purchasers, which will include the erection of a concrete dam and a new power house at Wendell. It is said that about 1600 hp will be developed. A new pole line will be erected from Wendell to Athol, and also to Erving, where it is expected that electricity will be furnished for lamps and motors. The Athol power plant will be maintained until the changes are completed at Wendell, when it will be discontinued and held for emergency purposes. A contract has been made with the Athol & Orange Street Railway Company to furnish it with electricity for operating its system from the Wendell plant.

BOSTON, MASS.—The Supreme Court has refused the Metropolitan Home Telephone Company permission to open 100 streets in Boston for the purpose of laying telephone wires.

BOSTON, MASS.—The Boston & Northern Street Railway Company has petitioned the Massachusetts Railway Commission for permission to issue bonds to the amount of $536,000, the proceeds to be used for improvements to its property.

BOSTON, MASS.—The Old Colony Street Railway Company has applied to the Massachusetts Railway Commission for an approval of an additional $275,000 in bonds, the proceeds to be applied to improvements to its system.

CHICOPEE, MASS.—It is said that the committee of electric lines of the Board of Aldermen at the next meeting of the board will recommend that all gas lamps now in use for street lighting to be replaced with 32-cp incandescent lamps, electricity for which to be supplied by the municipal electric light plant.

LUNENBURG, MASS.—The Selectmen have entered into a contract with the Leominster Electric Light & Power Company to light the streets of the town for a term of five years. The company will extend its transmission line from Whalon to this village.

PITTSFIELD, MASS.—The Pittsfield Electric Company has awarded the contract for laying one-half mile of conduits to G. M. Gest, of New York, N. Y., to cost $7,500. The contract for cables has not yet been awarded.

SHEFFIELD, MASS.—Representatives of both Great Barrington Electric Light Company and the Canaan Light & Power Company have been making investigations with a view of extending the transmission lines from either place in case sufficient business is secured to guarantee the expenditure.

SPRINGFIELD, MASS.—It is reported that the Northern Connecticut Light & Power Company proposes to acquire the locks and dams at Enfield and Windsor Locks, Conn., owned by the Connecticut River Company.

WORCESTER, MASS.—By a decision of the Supreme Court the Postal Telegraph Company will be obliged to place its wires underground in Worcester.

KALAMAZOO, MICH.—Arrangements are being made to improve the lighting service at Oakwood Park and Oakwood Heights. Heretofore electricity for lighting Oakwood Park has been furnished from a small plant operated on the grounds, but the M. U. R. has decided to secure the service direct from the Commonwealth Power Company for both suburbs. The Oakwood Heights Realty Company and the M. U. R. will pay for cost of the extension of the transmission lines, which it is estimated will cost about $1,000. J. L. Millspaugh is superintendent of the M. U. R.

BELLE PLAINE, MINN.—The City Council has granted a franchise to Arndt & Rockwelter, of St. Paul, Minn., to install an electric light and power plant.

HAWLEY, MINN.—The citizens on May 20 voted to issue $16,000 in bonds for the construction of an electric light plant and water works system. J. E. Johnson is recorder.

NORTHFIELD, MINN.—The trustees of Carleton College are considering the question of installing a central heating and power plant to furnish electricity and heat for all the college buildings, at a cost of between $30,000 and $40,000.

ST. PAUL, MINN.—Announcement has been made by M. W. Savage, president of the Dan Patch Electric Railway, now under construction between the Twin Cities and points in Southern Minnesota, that arrangements have been made for financing a $4,000,000 loan for the construction of the railway. Thirty miles of the road have been graded.

SHAKOPEE, MINN.—Bids will be received until July 13 for a 50-kw generator for the municipal electric light plant. C. T. Weiland is city recorder.

COLUMBIA, MO.—The City Council has granted the Mexico, Perry & Santa Fe Traction Company a franchise to operate an electric railway in Columbia. The proposed railway will be 60 miles in length.

FRANKFORD, MO.—A committee consisting of J. D. Pitt, J. G. Cash and J. B. Jones, has been appointed to make investigations toward the installation of an electric light plant.

MACON, MO.—Plans are being made for organizing the Hannibal-Palmyra-Bethel-La Platta-Kirksville interurban railway, which will be incorporated under the name of the Muldrow Route. The railway is to be built strictly on the co-operative plan. Henry Funk is chief promoter.

NEVADA, MO.—The plant and holdings of the Missouri Water, Light & Traction Company were sold at auction May 15 by Hiram Phillips, receiver, to A. Mitchell, of St. Louis, Mo. The property was sold under foreclosure of $161,200 first mortgage bonds, held by the Lincoln Trust Company of St. Louis, Mo., and includes electric light plant, water works system and electric railway.

HELENA, MONT.—We are informed that the Montana Rapid Transit Company is planning to commence work soon on its electric railway, which will connect Helena and Butte, 72 miles in length. Spurs will be built from East Helena to Lakeview, an amusement resort; and from Jefferson to Wickes, via Corbin. The company has secured the grade of the Northern Pacific Railroad out of Helena. No contracts for material have been awarded as yet. Arrangements have been made by the company with the United Missouri River Power Company for electricity for operating the railway. Joseph K. Toole is president of the company.

KALISPELL, MONT.—The Northern Idaho-Montana Power Company has purchased the plant and holdings of the Kalispell Water & Electric Company, and it is said that the company proposes to make extensive improvements, which will involve an expenditure of about $200,000.

The company also contemplates extensive improvements to its plant at Big Bend, at a cost of about $100,000.

CALLAWAY, NEB.—The Callaway Light & Power Company, it is said, will petition the City Council for a franchise to light the village.

HAWTHORNE, NEV.—Plans are being made for the development of the water power near Mono Lakes, Cal., about 30 miles from Bodie. It is proposed to install a plant with an initial output of 2500 hp which will supply electricity to the Aurora, Masonic, Lucky Boy, Hawthorne, and contiguous mining districts. J. S. Cain, John Miller, J. E. Adams, A. J. McCune and H. M. Goram, of Los Angeles, Cal.; C. F. Collins, of St. Louis, Mo., and others are interested in the project. Preliminary surveys have been completed for the plant.

CANAAN, N. H.—It is reported that the grist mill water power will be utilized for an electric light plant.

ALLENHURST, N. J.—At a special election held recently the citizens voted to sell the distributing system of the municipal electric light plant to the Atlantic Coast Electric Light Company, for $15,000, which hereafter will furnish electrical service in this borough. A bill was recently passed by the State Legislature allowing the town to sell the plant.

DOVER, N. J.—Arrangements are being made by the Morris County Traction Company, of Morristown, N. J., for the erection of a 1000-hp motor generator plant at its car house in Dover. The plant will be of the direct-current system, and will furnish electricity to operate the cars between Morristown and Dover.

WEST ORANGE, N. J.—Arrangements are being made by the Mountain Railway Company for the construction of a half mile extension to Essex County Park, contracts for which will be awarded within the next six weeks.

AUSABLE CHASM, N. Y.—Joseph A. Powers, of Troy, N. Y., has purchased the Ausable Nail Works in Ausable Chasm, including the water rights in the river, which includes a 60-ft. dam, which is capable of developing about 2000 hp. It is said that the power will be utilized to generate electricity, which will be distributed in this vicinity.

BABYLON, N. Y.—The Babylon Railroad Company has been granted permission by the Public Service Commission, Second District, to extend its railway from its present terminus in this village to Amityville, a distance of 5.81 miles. The company is also authorized to increase its capital stock from $25,000 to $75,000, and to issue common stock to the amount of $50,000, the proceeds to be used in the construction of a new ferry line connecting with its railway in Babylon, at a cost of $38,000. It has also been given permission to execute a mortgage upon all its property and holdings to secure an issue of bonds to the amount of $300,000, to be sold at not less than 5 per cent of their par value, to be used in the payment of indebtedness incurred in reconstructing its line by the Long Island Railroad, $26,308; payment of further reconstruction of its line, $16,180; extension from Babylon to Amityville, $126,000; and other expenses.

BROOKLYN, N. Y.—Bids will be received by Bird S. Coler, borough president, until June 9 for furnishing and installing pumping engine and power plant for operating Gowanus flushing tunnel, in the Borough of Brooklyn. Blank forms and further information can be secured and plans and specifications may be seen at the office of Bureau of Sewers, 215 Montague Street, Brooklyn.

BUFFALO, N. Y.—Contracts have been awarded by the Board of Trustees for the new electric light plant for the city hall as follows: For wiring, to McCarthy Brothers & Ford, for $23,280; generators to the Allis-Chalmers Company, for $3,650; engines, to the Skinner Engine Company, for $4,935, and for steam-fitting to Timothy McAvoy & Son, for $1,465.

BUFFALO, N. Y.—Only one bid was received for supplying electricity for operating the three centrifugal pumps at the pumping station, which was submitted by the Cataract Power & Conduit Company, offering to supply the service at the rate of $25 per horse-power per year, which is the same price that the city now pays. The city is to install and maintain the transmission lines from the company's lines in Niagara Street to the pumping station and to contract for a certain amount.

DANSVILLE, N. Y.—The Dansville Gas & Electric Company has been authorized by the Public Service Commission, Second District, to execute a first and refunding mortgage for $125,000 to secure an issue of like amount in bonds, of which $75,000 are to be set aside to be used for redemption of bonds of same amount outstanding; $20,000 are to be sold at not less than par, the proceeds to be used as follows: $9,000 to be applied for the discharge of outstanding debts; $9,000 for payment of the cost of new extensions and improvements, and $2,000 for the purpose of providing a working capital.

FORT TOTTEN, N. Y.—Bids will be received by the constructing quartermaster at Fort Totten, N. Y., for the installation of an electric light system at this post.

FULTON, N. Y.—The Common Council has granted a franchise to the Niagara-Oswego Power Company. Under the terms of the franchise the company will be required to have in operation a steam plant with an output of 1,000 hp within nine months, and a surety bond of $50,000 be given as guarantee to have it in operation. It also provides that its wires must be placed underground on several of the principal streets in the city.

JAMESTOWN, N. Y.—The Mayor has recommended to the Common Council the proposition to purchase the property of the Home Telephone Company. A committee has been appointed to obtain the lowest price the company will sell the plant. At a recent appraisal of the property the plant was valued at $286,000.

KENMORE, N. Y.—The Frontier Telephone Company has petitioned the Town Board for permission to erect a telephone line along the river road to connect with the Wickwire steel plant.

NEW YORK, N. Y.—Mayor McClellan has signed the franchise authorizing the South Shore Traction Company to construct and operate a railway across Queens Borough and the new bridge.

NEW YORK, N. Y.—Bids will be received by John H. O'Brien, commissioner water supply, gas and electricity, until June 7 for furnishing and maintaining electric lamps for lighting streets, avenues, parks and public places from June 7 to Dec. 31, 1909, inclusive, in the Borough of Manhattan. Blank forms may be obtained at the Department of Water Supply, Gas and Electricity, Room 1319, 21 Park Row, New York, N. Y.

NEW YORK, N. Y.—Proposals will be received by C. B. J. Snyder, superintendent school buildings, Department Education, corner Park Avenue and Fifty-ninth Street, New York, N. Y., until June 8, for repairs, alterations and additions to the electric equipment in Public Schools 14, 26, 28, 51, 57, 70, 127, 141 and 166, Borough of Manhattan. Blank forms, plans and specifications may be obtained or seen at the above office.

SENECA FALLS, N. Y.—The Public Service Commission, Second District, has granted the petition of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company for permission to extend its railway across Cayuga Lake to Auburn. The commission also granted the company permission to change its name to the Geneva & Auburn Railway Company.

SYRACUSE, N. Y.—The Public Service Commission, Second District, has authorized the Oswego County Light & Power Company to increase its capital stock from $100,000 to $1,000,000, and to issue $4,000,000 in bonds. The company proposes to develop the water power of Salmon River in Oswego County, and will furnish electrical service in Syracuse.

WEST POINT, N. Y.—Proposals will be received at the office of the quartermaster, West Point, N. Y., until June 21 for furnishing and installing electric and combination gas and electric light fixtures in the post headquarters as per plans and specifications in the above office. Forms of proposals furnished on application.

WASHINGTON, N. C.—The Traction Engineering Company, of New York, N. Y., which is now installing an electric railway system in Washington, it is said, will make a proposition to the town to lease the municipal electric light plant, and operating both as one system, under which the city will derive a reasonable profit from the plant.

COLUMBUS, OHIO.—Plans are being prepared by Harold M. Bush, mechanical engineer, Columbus, Ohio, for additions and improvements to the power plant of the Girls' Industrial School, which will include the construction of a new power house, 200-hp. water tube boilers, heaters, hot water pumps, induced draft apparatus, economizer; two 75-kw. generators and engines, vacuum steam heat system, and domestic hot water supply. An appropriation of $49,000 has been made for the work. Contracts will probably be let about July 1.

GALLIPOLIS, OHIO.—The gas plant of the Gallipolis Gas & Electric Company, it is reported, was closed May 20, owing to the plentiful and cheap supply of natural gas from Galion. The electric division will be kept in operation.

LIMA, OHIO.—The Lima Telephone Company has commenced work on extensive improvements to its system, which will involve an expenditure of about $75,000 and include the installation of about 25 miles of underground conduit duct and the erection of about eight miles of aerial cable. George Matheany is manager.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company has awarded the contract for steel work for its new power plant to be erected on Buck Creek, near North Fountain Avenue, to the Scriebler Company, of Cincinnati, Ohio. The contract for condensers and steam turbine engines was awarded to the Wheeler Condenser Company, of New York, N. Y.

CHICKASHA, OKLA.—The Public Service Company, of Chickasha, recently incorporated, with a capital stock of $750,000, has taken over the plant of the Chickasha Water Power Company and the gas plant in Chickasha. The officers of the new company are: C. Townsend Blake, president; William T. Croslen, vice-president; C. L. Green, secretary, and T. H. W. Williams, treasurer, all of Hobart, Okla.

EL RENO, OKLA.—Plans are being considered by the El Reno Gas & Electric Company for the reconstruction of its distributing system and adding five miles of pole line. H. H. Stephens is manager.

OKLAHOMA CITY, OKLA.—Plans are being made by the Pioneer Telephone Company for extensions and improvements to its system, which will include the placing of its wires underground in the business section of the city and erection of two aerial lines. The company also proposes to improve its system in Anadarko. Orders have been placed by the company for 350,000 lb. of copper wire at a cost of $60,000.

DRAIN, ORE.—C. W. Benvouis, village secretary, writes that at present there is no electric plant in Drain, but that there is a good opening for a plant in the town.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has notified its patrons in the section between Jefferson, Oak, Front and Park streets that all motors in that district are to be supplied by direct-

current service as soon as the new sub-station at Seventh and Adler streets is placed in operation. The change in the system will affect several thousand motors.

UNION, ORE.—The City Council has passed the ordinance authorizing an issue of $25,000 in bonds for establishing an electric light plant and calling for an election Aug. 16 to vote on the proposition.

EMAUS, PA.—Plans and specifications for the proposed plant to be erected by Messrs. Yeager & Chapin, who were recently awarded the contract for street lighting by the Borough Council, have been prepared, and if approved by D. R. Miller, borough burgess, work will commence at once on construction of the plant. The Allentown Electric Light & Power Company is furnishing the street lighting service at present.

IRWIN, PA.—Application will soon be made for a charter for the Irwin-Herminine Traction Company, which proposes to construct an electric railway along Sewickley Avenue in Herminine, to the Mt. Pleasant Pike, thence to Irwin and along the Guffey station road to Hahntown, a distance of about four miles. William S. Rial is solicitor.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 26 for motor generator sets, exciters, switchboard, etc., for U. S. Navy Yard, Philadelphia, Pa. Specifications can be obtained on application to the bureau or to the commandant of the navy yard named. The cost of the work is estimated at $17,550. R. C. Holiday is Chief of Bureau.

WOONSOCKET, R. I.—Plans are being made by the Woonsocket Electric & Machine Company to replace the present street lamps with luminous magnetite arc lamps. The change will be made without any additional cost to the city.

CHESTER, S. C.—The Chester Power Company has been chartered as subsidiary to the Southern Power Company, to take over the local electric lighting interests. The company is now overhauling the lines and making preparations to supply electricity for all purposes, including contracts for several industrial enterprises.

CLEMSON COLLEGE, S. C.—Clemson College, the state college, proposes to build a short electric railway from the college to Calhoun, to be used for both freight and passengers. Ninety-pound rails will be laid. Further extensions of the railway may follow.

SUMTER, S. C.—W. E. Brunson contemplates developing a water power to be utilized to generate electricity. It is proposed to develop about 360 hp at a cost of about $20,000.

LEAD, S.D.—The Homestake Mining Company, which has a large mining plant near Lead, is installing a new electric power plant, at a cost of about $1,000,000.

MADISON, S. D.—Contracts for additional equipment for the municipal electric plant have been awarded as follows: To the Minneapolis Steel & Machinery Company for producer-gas engine, at $16,000, and for dynamo to the Fort Wayne Electric Works, for $3,660. William Rae, City Auditor.

KNOXVILLE, TENN.—The People's Telephone & Telegraph Company contemplates installing a direct circuit from Sevierville to Knoxville.

WINCHESTER, TENN.—The citizens have voted to issue $7,000 in bonds to rebuild the municipal electric light and water plant. A new water wheel and generator will be installed. William J. Dodge, of Estill Springs, Tenn., is superintendent.

CALVERT, TEX.—The Calvert Water, Ice & Electric Light Company is planning to make extensive improvements to its system, which will involve an expenditure of about $40,000. G. W. Sonnerfield, of Dallas, Tex., has been awarded the contract for the construction of a new power house.

EL PASO, TEXAS.—Richard Caples and W. B. Latta, representing the stockholders of an interurban electric railway which is to be constructed from El Paso to Fabens, have petitioned the City Council for a franchise to construct an electric railway through the city.

GONZALES, TEX.—It is reported that the Gonzales Electric Light & Power Company has placed a contract with the Westinghouse & Manufacturing Company, Pittsburg, Pa., for a 350-kw generator. The company proposes to furnish electricity for cotton mills and other local industries.

MARFA, TEX.—The Marfa Power Company has changed its name to the Marfa Telephone Company and increased its capital stock from $3,500 to $5,000.

TOYAH, TEX.—The plant and holdings of the Toyah Light & Telephone Company have been purchased by a new company recently organized, with a capital stock of $15,000, which proposes to enlarge and improve the service. A contract has been let for the construction of a new power house in which the telephone exchange will also be operated. Orders have also been placed for a new engine and generator. The officers of the company are: B. P. Vanhorn, president; A. G. Vanhorn, vice-president and general manager, and J. V. Gage, secretary and treasurer.

MURRAY, UTAH.—Application has been made by Murray City to the State Engineer for 15 cu. ft. per second of water from Little Cottonwood Creek, to be utilized to generate electricity, which will be distributed in Murray for lamps and motors. A channel of 10,880 ft. will be built, with dam capable of developing 750 hp.

OGDEN, UTAH.—It is reported that the Utah Light & Railway Company will reconstruct its system and the generating division will be remodeled.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company is reported to have awarded a contract to the Allis-Chalmers Company, Milwaukee, Wis., for a duplicate of the 1250-kw motor generator in its plant furnished by the company last winter, at a cost of $25,000.

BRATTLEBORO, VT.—At a special meeting of the stockholders of the Connecticut River Transmission Company held recently the capital stock of the company was increased from $2,500,000 to $3,200,000. The company is constructing a large hydro-electric plant at Vernon, Vt., which is nearly completed. It is announced that the plant will be in operation early in June and will have an output of about 27,000 hp. Henry I. Harriman, president of the company, states that contracts have been placed amounting to about $275,000, which only represent about 30 per cent of the available primary power, and 60 per cent of the secondary power.

BURLINGTON, VT.—The price of electricity has been reduced to five cents per kw-hour to all consumers using over 100 kw hours per month. The commissioners of the electric light plant have also been authorized to make special rates for electricity for special illumination. The new rate takes effect from May 1, 1909.

CHARLES CITY, VA.—The Charles City Telephone Company is making arrangements to commence work on the erection of its telephone lines, and is securing rights of way to Roxbury and other points to be reached by the system.

MONTPELIER, VT.—The Corry, Deavitt & Frost Electric Company, which furnishes electricity to operate the Barre & Montpelier Traction Company's system, has decided to erect a second power plant for the purpose of furnishing electricity for power purposes. Its present plant is not quite completed, but has been in operation since the first of March. It is expected to develop 1000 hp under a 60-ft. head. P. S. Tirrill is superintendent.

NEWPORT, VT.—Arrangements are being made by the Newport Electric Light Company to increase the output of its plant, which will include the installation of a 750-hp Curtis steam turbine.

PORTSMOUTH, VA.—We are informed that the city of Portsmouth has abandoned the project to erect a municipal electric light plant, and has awarded a contract for electric lighting for a term of ten years from January 1, 1910, to the Portsmouth & Norfolk Corporation, under the terms of which the company is to have its plant in operation by January next. As yet no visible steps have been taken toward the construction of the plant. T. J. Wool, of Portsmouth, Va., is president of the company.

DAVENPORT, WASH.—The local electric light plant of the Big Bend Light & Power Company, which has been out of commission for some time, has been dismantled. Electricity for operating the local system is transmitted from Spokane.

ODESSA, WASH.—The Washington Water Power Company is contemplating extending its system to Odessa in the near future if a satisfactory franchise can be secured. The company agrees to install a system provided it is given a contract to operate the city pumping station and sufficient power contracts can be secured.

PROSSER, WASH.—The Benton Independent Telephone Company has purchased the franchise and equipment of the Prosser Telephone Company.

SEATTLE, WASH.—The City Council has passed an ordinance authorizing the installation of a system of cluster lamps on Union and other streets.

SEATTLE, WASH.—The Skagit Power Company, which was granted permission by the Government in March to construct flumes and conduits in the national forest reserve, through which the Skagit River passes, will soon be ready to commence work on its large power plant in a short time. The plant will be completed in four years and will develop from 50,000 to 60,000 hp. The water will be carried a distance of 17,000 ft. above the plant through a tunnel to be opened. C. H. Freeman is treasurer, and C. C. Conkle manager of the company.

SPOKANE, WASH.—The plant and holdings of the Spokane Falls Gas Company have been purchased by Henry L. Doherty, of New York, N. Y., and associates, who control various light and traction companies throughout the country. The franchises held by the company are considered especially valuable, and include water rights on the Spokane River.

TACOMA, WASH.—Surveys are being made by the Thunder Creek Transportation Company for the construction of a railway across the mountains, for which rights of way have been secured from the Department of the Interior.

FAYETTEVILLE, W. VA.—Application has been made by R. H. Dickinson for a franchise to build and operate an electric light system in Fayetteville. W. L. Lee is Mayor.

FORT ATKINSON, WIS.—The stockholders of the Jefferson County Telephone Company have decided to sell the local system to the Wisconsin Telephone Company. The Wisconsin company is to pay $967 in cash and $21,967 in stock, and is also to assume the $5,200 indebtedness of the Jefferson company. The system will be taken over July 1.

OCONTO, WIS.—Plans are being made by the Oconto Rural Telephone Company to commence work on the erection of seventeen miles of telephone line.

SHEBOYGAN, WIS.—The Mosel & Centerville Telephone Company has increased its capital stock from $5,000 to $15,000.

WATERTOWN, WIS.—Extensive improvements are under way by the Watertown Gas & Electric Company, which will include the construction of a new power house and dam at the Rough-and-Ready water power site. The equipment will include two water wheels direct connected to generators and a rotary converter and transformers. The transmission line will connect with the line from the Kilbourn dam.

WELCOME, WIS.—The Fox River Telephone Company, of Appleton, Wis., has been granted a franchise to erect a telephone system in Welcome. The company will commence work at once on the erection of a telephone line from New London to this village, a distance of 10 miles.

LETHBRIDGE, ALTA., CAN.—The Alberta Government has decided to install an automatic telephone system here. For further information address W. H. Cushing, minister of works.

LETHBRIDGE, ALTA., CAN.—Contracts for the construction of the municipal electric light plant have been awarded as follows: For mechanical draft and economizer to the Polson Iron Works, of Toronto, Ont., for $6,890; complete piping to Drummond, McCall & Company, of Montreal, Que., for $14,365; for crane to Mussen's Ltd., for $1,700; boilers and accessories to the Babcock & Wilcox Company, of Montreal, Que., for $25,410; feed pumps to the Canada Foundry Company, of Toronto, Ont., for $730; transformers to the North West Electric Company, of Calgary, Alta., for $1,320; electrical equipment to the Canadian Westinghouse Company, of Hamilton, Ont., for $1,449, and to Laurie & Lamb, of Montreal, Que., for engine and condensing sets, for $18,575.

CRESTON, B. C.—The Goat River Power & Light Company proposes to construct a power plant on the Goat River Canyon and will furnish electricity for lamps and motors and other purposes. The company also plans to construct an electric railway to extend from Creston to the Goat River, ten miles in length, work on which will commence within a year. The officers of the company are: R. S. Lennie, of Nelson, B. C., president; W. K. Essling, of Rossland, B. C., vice-president; J. B. Anderson, of Trail, B. C., secretary and treasurer, and W. F. Teetzel, Nelson, B. C., general manager.

HAMBURG, ONT., CAN.—Preparations are being made by the People's Railway Company for the construction of its proposed electric railway, which will connect Stratford, Woodstock, New Hamburg, Berlin, Guelph and intervening towns, work on which will commence in the near future. The proposed railway will be about 88 miles in length. Electricity for operating the road will be purchased from the Hydro-Electric Power Commission. A. N. Warfield, of New Hamburg, is construction engineer.

HAMILTON, ONT., CAN.—Preparations are being made by the Cataract Power Company for the new lighting contract which goes into effect July 1. Additional lamps are to be installed. It is said that there will be no gas lamps used after July 1.

OTTAWA, ONT., CAN.—The bill to incorporate the Michigan & Ontario Power Company has been passed by the Parliament.

TORONTO, ONT., CAN.—The Board of Control has awarded the contract for lighting the newly annexed district of Wychwood to the Toronto Electric Light Company at a rate of $69 per lamp per year.

TORONTO, ONT., CAN.—Tenders will be received by the City of Toronto, Ont., until June 30 for laying between 350,000 and 450,000 duct ft. of underground conduit. For specifications, form of tender, etc., apply to Electrical Department, City Hall. K. L. Aitken is electrical engineer.

GOVAN, SASK, CAN.—Sealed tenders will be received by T. Fargey until June 15 for the construction of approximately 60 miles of telephone line for the Govan Telephone Company.

JIMENEZ, MEX.—A. J. Warren and C. D. Norton, owners of the local electric light plant, contemplate extending their transmission line a mile or more to the south and installing a new boiler in their plant to provide power for a day service, and also installing several small direct-connected centrifugal pumps for irrigating purposes and furnishing power for operating a couple of flour mills.

New Industrial Companies.

THE J. ALEXANDER MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture electric fixtures and apparatus, etc., by J. Alexander, A. S. Alexander, C. H. Cairns and I. H. Alexander, of New York, N. Y.

THE AMERICAN ACCUMULATOR COMPANY, of Camden, N. J., has been incorporated with a capital stock of $500,000 by E. E. McWhiney, S. Moor and F. A. Kuntz, all of Camden, N. J.

THE BRAUN-ELECTRA-AUTOMATIC WEIGHING MACHINE COMPANY, of Jersey City, N. J., has been chartered by W. F. Braun, H. O. Coughlan and S. A. Anderson, of Jersey City, N. J. The company is capitalized at $375,000 and proposes to manufacture automatic weighing machines.

THE COMMERCIAL TRACTOR COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 for the purpose of manufacturing traction wheels, engines, motors, etc. The incorporators are: B. M. Beskow, of New York, N. Y.; C. S. Kellogg, of Montclair, N. J., and E. O. Kannofsky, of Brooklyn, N. Y.

THE COUPLE-GEAR COMPANY, of New York, N. Y., has been chartered with a capital stock of $50,000, for the purpose of manufacturing motor vehicles, electric and other motors, cars, vehicles, etc. The incorporators are: W. H. Kennard, F. B. King, of New York, N. Y., and H. Greene, of Cranford, N. J.

THE GENERAL RAILWAY EQUIPMENT COMPANY, of Portland, Maine, has been incorporated with a capital stock of $3,000,000 to manufacture railroad supplies. The officers are: C. E. Eaton, president; T. L. Croteau, treasurer, and A. W. Tolman, clerk, all of Portland, Maine.

THE HILL-HUPFEL ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $200,000 to act as consulting engineers and to design and build steam turbines, gas engines, etc., by H. P. Hill, O. G. Hupfel and C. E. Whitney, all of New York, N. Y.

THE INTERNATIONAL ILLUMINATING COMPANY, of Newark, N. J., has been chartered with a capital stock of $1,000,000 for the purpose of manufacturing gas burners, chandeliers and electroliers. The incorporators are: Robert H. Smith, Gustave Oestrecheicher and Richard W. Cobb.

THE JERSEY CITY ELECTRIC COMPANY, of Jersey City, N. J., has been chartered with a capital stock of $25,000, to do a general electrical engineering business. The incorporators are: C. Thomas, E. Thomas and E. G. Thomas, all of Jersey City, N. J.

THE LINCOLN ENGINEERING COMPANY, of Portland, Ore., has been chartered with a capital stock of $10,000 for the purpose of manufacturing electrical machinery. The officers are: L. V. Walker, president; F. L. Pennell, treasurer, both of Portland, Maine; G. W. Craigie, of Westbrook, Maine, clerk.

THE MERCHANTS ELECTRIC COMPANY, of Wilmington, Del., has filed articles of incorporation with a capital stock of $150,000. The incorporators are: H. H. Ward, G. G. Steigler and A. C. Gray, of Wilmington, Del.

THE METAL BOILER CLEANER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 to sell a metal compound for cleaning boilers, by J. J. Harper, E. J. Forhan and H. M. Browne, all of New York, N. Y.

THE MILES-WILDERMAN ELECTRIC COMPANY, of St. Louis, Mo., has been organized for the purpose of doing a general contracting business and to act as representatives for specialties in the electrical business by C. F. Miles and L. C. Wilderman. The company would like to receive catalogs from manufacturers with discounts to dealers.

THE NEWCOMB ENGINE COMPANY, of Harrison, N. Y., has been incorporated by W. B. Thompson, of Union Course, N. Y.; O. A. Hack, E. C. Chamberlain, of New York, N. Y. The company is capitalized at $200,000 and proposes to manufacture motors, engines, automobiles, etc.

E. A. OLLEY & COMPANY, of Syracuse, N. Y., has been chartered with a capital stock of $20,000 by Ellery A. Olley, Raymond H. Olley, Edwin A. Olley and Joseph C. Belle Isle, of Syracuse, N. Y. The company proposes to deal in electrical goods and to do electrical work.

THE OXFORD TELEPHONE HANGER COMPANY, of Fayetteville, Ark., has been incorporated with a capital stock of $500,000, and the following named officers: C. E. Oxford, president; Harold H. Tittman, of St. Louis, Mo., vice-president. The company proposes to manufacture the Oxford detachable cabinet telephone, using the Oxford hanger.

BERNARD F. PIEL, of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of $10,000, for the purpose of manufacturing engines, boilers, machines, tools, hardware, etc. The incorporators are: A. M. Piel, George C. Schneider and Paul F. Stein, all of Brooklyn, N. Y.

THE P. & F. ELECTRIC COMPANY, of Chicago, Ill., has been chartered by Arthur F. Poole, Louis J. Flint and George C. Knauff. The company is capitalized at $2,500, and proposes to do a general electrical and engineering business.

THE PUBLIC SERVICE CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 by Charles C. Mann, John C. Bishop and James J. McMahon, all of New York, N. Y. The company proposes to manufacture mechanical and electrical apparatus.

THE RAE ELECTRIC VEHICLE COMPANY, of Wilmington, Del., has filed articles of incorporation with a capital stock of $150,000. The incorporators are: C. F. Clendennin, N. F. Griffin, of New York, N. Y., and S. A. Love, of Philadelphia, Pa.

THE TESLA PROPULSION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $1,000,000 to manufacture hydraulic, steam, gas and pneumatic machinery for vessels. The directors are: Nicola Tesla, Joseph Hoadley and Walter H. Knight, all of New York, N. Y.

THE WENTWORTH-DEAN COMPANY, of Lima, Ohio, has been incorporated with a capital stock of $10,000. The company proposes to manufacture and deal in electrical supplies. The officers of the company are: E. A. Dean, president; E. H. Wentworth, vice-president, and Walter Dean, secretary and treasurer.

WESTON MANUFACTURING COMPANY, of Binghamton, N. Y., has been incorporated with a capital stock of $10,000 by Marsh Miller, Frank T. Macey and Oscar W. Alston, of Binghamton, N. Y. The company proposes to manufacture mechanical appliances, devices, machines and machinery.

New Incorporations.

BARDSTOWN, ARK.—The Bardstown Telephone Company has been chartered with a capital stock of $2,500 by J. M. Ward, L. L. Ward, H. S. Portis and W. H. Davis, all of Bardstown, Ark.

MAMMOTH SPRINGS, ARK.—Articles of incorporation have been filed for the Mammoth Springs Electric Light & Power Company with a capital stock of $10,000, by Napoleon Hill, president; E. C. Parham, E. C. Bellamy and Frank P. Hill.

WILMINGTON, DEL.—The People's Light & Fuel Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are: I. W. Keere, Mason City, Ia.; O. B. Matthews, A. L. Childs, E. B. Grande, Grinnell, Ia., and H. W. Davis, of Wilmington, Del.

CHICAGO, ILL.—The Interstate Light & Power Company, a New Jersey Corporation, has filed articles of incorporation with the Secretary of State. The company is capitalized at $750,000, and proposes to operate light, heat and power plants.

CRAWFORDSVILLE, IND.—The Crawfordsville Heating & Lighting Company has incorporated for the purpose of constructing and equipping a heating, lighting and water plant. H. R. Ristine, W. P. Herron, James E. Evans and others are incorporators.

RUSHVILLE, IND.—The Lot Green Telephone Company has incorporated to construct and operate a telephone plant in Rush County, with home office in Rushville. The company is in the market for material and equipment for a new plant. Henry Schrader, Amos Blackledge and Thos. A. Dell are directors.

TOPEKA, KAN.—A charter has been granted to the Kansas-Colorado Construction Company, of Lawrence, with a capital stock of $100,000. The company proposes to construct a railway and electrical transmission plant from Western Kansas and Colorado, in the Arkansas Valley. J. D. Bowersock, of Lawrence, is president of the company and Charles Sutton is general manager.

HEATH, KY.—The Heath Telephone Company has been incorporated with a capital stock of $1,000 by T. M. McGee, D. W. Murphey, A. P. Hill, J. D. Rives, and others.

SPRINGFIELD, MASS.—Articles of incorporation have been filed for the Hall Tide Power Company with a capital stock of $500,000 for the purpose of producing power by means of tides. A. Wooley, of Chicopee, Mass., is president, and J. Hall West, of Somerville, Mass., treasurer.

JACKSON, MISS.—The Mississippi Home Telephone Company has been chartered with a capital stock of $250,000. It is said that the company will commence work at once on the construction of an automatic telephone system in this city, and will place its wires underground. The company has right of way to Meridian, a distance of 96 miles, and to Hattiesburg, 80 miles. George C. Graeber, of Shamokin, Pa., is president of the company, and N. D. Smith, of Jackson, local representative.

CLINTON, MO.—The Western Power & Transportation Company has been incorporated with a capital stock of $50,000 by William F. Hall, R. H. Pierce and L. H. Hall. The company proposes to construct and operate steam, water, gas and electric lighting and heating plants.

BLADEN, NEB.—The Bladen Rural Telephone Company has decided to consolidate with the Glenwood Rural Telephone Company, the change to take effect July 1.

CAMDEN, N. J.—The Phoenix Water Power Company has been chartered, with a capital stock of $150,000, for the purpose of developing water power to be utilized to generate electricity. The incorporators are: F. R. Hansell, G. H. B. Martin and J. A. MacPeak, all of Camden, N. J.

GLEN RIDGE, N. J.—The Telegraphatype Company has been incorporated, with a capital stock of $50,000, by W. M. Beard, of Glen Ridge, N. J.; W. F. Paret, of Essex Falls, N. J., and M. V. Moran, of Jersey City, N. J. The company proposes to maintain telegraph and telephone lines.

JERSEY CITY, N. J.—The Low Moor Conduit Company has been incorporated with a capital stock of $5,000 by C. R. Ganter, of New York, N. Y.; George H. Stover, of New Dorp, N. Y., and Edward H. Green, of New York, N. Y.

LAS VEGAS, N. M.—Articles of incorporation have been filed for the Las Vegas Light & Power Company, with a capital stock of $300,000, by J. M. Cummings, William G. Hayden and William S. Iliff, of Denver, Col.

CERES, N. Y.—The Kings Run Telephone Company has been chartered with a capital stock of $2,000 by H. N. Hackett, H. J. Butler and C. C. Faulkner, of Ceres, N. Y., and others.

HILLSDALE, N. Y.—Articles of incorporation have been filed for the North Hillside & Green River Telephone Company with a capital stock of $4,500 by E.Herrington, Frank J. Shaw and Frank Mercer, of Hillsdale, N. Y., and others.

NEW YORK, N. Y.—The Upper Broadway Railway Company has filed articles of incorporation with the Secretary of State for the purpose of constructing and operating a street railway in the Borough of Manhattan 3½ miles in length from Twelfth Avenue along Manhattan Street to Broadway to St. Nicholas Avenue to Fort George Avenue. The company is capitalized at $750,000, and the incorporators are: Morgan D. Wilson, Arnold F. Wainwright and Charles F. Heddin, all of New York, N. Y.

SPENCERTOWN, N. Y.—Articles of incorporation have been filed for the Spencertown Co-operative Telephone Company, with a capital stock of $1,000, by Henry W. Niles, of Chatham, N. Y.; D. O. Sawyer, David W. Lasher, of Spencertown, and others.

CALABASH, N. C.—The Southport & Little River Telephone Company has been incorporated, with a capital stock of $1,000, by M. J. Corbett, N. W. Divine and R. R. Stone, all of Wilmington.

GIBSONVILLE, N. C.—The Gibsonville Telephone Company has been incorporated, with a capital stock of $5,000, by C. E. Jordan, J. V. Dick and others.

HERTFORD, N. C.—The Belvidere Telephone Company has been chartered with a capital stock of $1,000 by L. W. Norman, G. W. Gaither and W. G. Gaither, Jr.

BERLIN, N. D.—The Lakeview Farmers' Mutual Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: H. G. Fenno, S. H. Darby, A. D. Knapp and others, all of Berlin, N. D.

GRANO, N. D.—The Grano-Lockwood Telephone Company has been incorporated with a capital stock of $10,000 by Eugene Mead, of Grano; F. S. Randolph, J. M. Johnson and others.

VELVA, N. D.—Articles of incorporation have been filed for the Progressive Farmers' Telephone Company. The capital stock of the company is placed at $50,000 and the incorporators are: George F. Mills, H. F. Harms and M. E. Bowers, all of Velva, N. D.

COLUMBUS, OHIO.—The Harrison & Jefferson Telephone Company has been incorporated with a capital stock of $250,000. The directors are W. P. Moore, president; C. F. Branson, C. P. McMillen, Lewis Hall, R. Cunningham, M. Moorehead, W. W. Wright and C. M. Osborne. The company is a consolidation of the Adena Exchange Telephone and the Harrison County Telephone companies.

PORT WILLIAM, OHIO.—The Port William Mutual Telephone Company has been incorporated, with a capital stock of $10,000, by J. A. Vandervort and others.

ZANESVILLE, OHIO.—Articles of incorporation have been filed for the Muskinghum & Morgan Railway, Light & Power Company by Andrew W. McDonald, Rufus C. Burton, William H. Pierpont, W. Hunter Atat and John J. Adams. The company is capitalized at $10,000.

FORT COBB, OKLA.—Articles of incorporation have been filed for the South Side Mutual Telephone Company, with a capital stock of $1,000. The directors are Stephen P. Ratcliff, William L. Keever and J. A. Campbell, all of Fort Cobb.

IDABEL, OKLA.—The Idabel Light & Power Company has been incorporated, with a capital stock of $10,000, by H. C. Morris, Charles Smith, W. D. Hinton, of Idabel, and E. B. Herendon, of Millerton.

McCURTAIN, OKLA.—Articles of incorporation have been filed for the City Electric Light & Power Company, with a capital stock of $6,000, by S. A. Shaw and D. R. Branham, of McCurtain, Okla.; C. C. Glenn, of Chant, Okla., and F. A. Handlin, of Fort Smith, Ark.

SHAWNEE, OKLA.—A charter has been granted the Shawnee Electric Company with a capital stock of $100,000 to construct two interurban railways through central Oklahoma. The first railway will extend from Shawnee through Prague and Okmulgee to Muskogee, a distance of 120 miles, and will cost approximately $3,000,000. The second line will run from Shawnee touching the towns of Dale, McCloud, Harrah and Choctaw County to Oklahoma City, 40 miles in length, the cost of which is estimated at $1,000,000. The incorporators are: C. T. Edwards, A. Hargraves, C. E. Easterwood, R. E. Pugh and W. S. Pendleton, all of Shawnee. A construction company capitalized at $10,000 was also granted a charter, incorporated by the same parties.

WHITEHORSE, OKLA.—Articles of incorporation have been filed for the Whitehorse Rural Telephone Company, with a capital stock of $600, by W. C. Douglass, M. E. Smith, C. R. Maher, L. D. Romig, L. Romig and H. G. Bosworth.

PILOT ROCK, ORE.—The Independent Telephone Company has been incorporated, with a capital stock of $3,000, by A. R. Turner and others.

PORTLAND, ORE.—The Inland Oregon Electric Railway Company has been incorporated by M. W. Gill, H. J. Martin and C. D. Charles. The company is capitalized at $1,000,000 and proposes to construct an electric railway from Condon to Canyon City, via Fossil. Another branch is to be built from Fossil through Wheeler, Wasco and Crook counties to the confluence of Trout Creek and Deschutes, where it will join the main line of the Portland-Baker City & Butte Electric Railway.

TROY, ORE.—The Mercantile Milling & Power Company has been chartered, with a capital stock of $20,000, by R. W. Barkham and H. E. Merryman. The company proposes to construct an electric railway from Troy to Hurricane Creek, a distance of about 12 miles. The headquarters of the company are located in Enterprise.

CALIFORNIA, PA.—Articles of incorporation have been filed for the California & Centerville Street Railways Company for the purpose of constructing an electric railway five miles in length in Washington County. The company is capitalized at $30,000, and the incorporators are: W. H. Francis, president; W. J. Weaver, H. C. Dunn, Joseph McLain and Harris Booker, of California, Pa.

PITTSBURGH, PA.—The Hebron Street Railway Company has been granted a charter to construct a street railway out on Frankstown Avenue and from Oakwood Street, Pittsburgh, to the Sandy Creek Road, a dis-

tance of two miles. The company is capitalized at $50,000, and the directors are: John S. Hershey, president; B. M. Sharp, D. W. Hoffman, C. W. Van Artsdalen and John S. Hershey.

SOMERSET, PA.—The Somerset & Bakersville Railway Company has been granted a charter to construct a railway from Rockwood to Bakersville, a distance of nine miles. Charles F. Hood, of Connellsville, is president.

RIPLEY, TENN.—The Ripley Light, Water & Ice Company has been incorporated, with a capital stock of $15,000, by J. W. Sanford, H. D. Folts, F. A. Henry, C. R. Barbee and others.

Legal.

A 50-YEAR FRANCHISE UPHELD BY THE INDIANA SUPREME COURT.—The Indiana Supreme Court has decided in favor of the validity of the franchise granted to Hester *et al.* by the Town Board of Greenwood, Ind. The court held that town boards can grant a valid franchise to a water and lighting company for a term of 50 years, though it cannot make contracts for service for longer than 25 years. The tax levied to pay for light and water was also upheld.

Personal.

MR. E. A. LOF, of the engineering staff of the Western Electric Company, has sailed for a short trip in Europe.

MR. C. A. S. HOWLETT, of the Western Electric Company, has been elected president of the National Sales Managers' Association.

DR. JOHN W. PRITCHARD, of Cardigan, Wales, has arrived in this country, where he will make a study of water-power and other electrical plants.

MR. G. E. REIFF has resigned from the Western Electric Company in order to accept a position with the Allis-Chalmers Company as designing electrical engineer.

MR. HARRY SHOEMAKER presented a paper June 2 before the Wireless Institute, New York, entitled "The Production of High-Frequency Oscillations."

MR. E. M. ADDIS has been appointed in charge of the Brattleboro, Vt., division of the Twin State Gas & Electric Company, succeeding Mr. F. P. Woy, who recently resigned.

MR. DAY BAKER delivered a lecture, illustrated by lantern slides, on May 27, before the New York Electrical Society, on the "Practical Application of the Modern Electric Vehicle."

MR. C. L. DE MURALT presented a paper May 26 before the University of Michigan, branch A. I. E. E., entitled "The Choice of a System of Electrification for Trunk Lines."

PROF. JOHN C. SHEDD, of Westminster College, Denver, has been appointed head of the department of physics of Pittsburgh University (formerly University of Western Pennsylvania).

MR. ETIS V. THURESSON, of Stockholm, Sweden, and chief engineer of a Swedish electrical development company, is on a visit to this country in order to inspect the more notable electrical plants.

MR. WALTER DANDLIKER has succeeded to the position of mechanical designer in the direct-current department of the Allis-Chalmers Company, made vacant by the recent resignation of Mr. C. C. Coppin.

MR. E. G. HOLZER, superintendent of the Easton Gas & Electric Company, of Easton, Pa., has been elected president of the Pennsylvania Gas Association. It has been decided to hold the 1910 convention in Easton on April 20.

MR. F. JOHN BELL has resigned as director and secretary-treasurer of the Canadian Crocker-Wheeler Company, Limited, Montreal. Mr. Bell has been connected with various engineering and commercial branches of the electrical business throughout Canada for many years.

MR. DONALD C. BARNES, for the past two years electrical engineer of the Edison Electric Illuminating Company of Brockton, Mass., has been appointed manager of the Pawtucket Electric Company, of Pawtucket, R. I., one of the Stone & Webster properties.

MR. JEFFERSON D. KEARNEY, of Chicago, formerly connected with the Central Electric Company and Zenco Electric Supply Company, and more recently a manufacturers' agent in the Monadnock Building on his own account, is confined to his home by a serious illness, which excites the gravest apprehension of his friends.

MR. LOUIS DUCOR, engineer of the contracting firm of Gères & Loucheur, Paris, is in this country on a tour of inspection to study American developments in high-tension power transmission, and of single phase and high-voltage direct-current railways. Mr. Ducor will remain here about 10 weeks and will visit some of the far Western cities before his return.

MR. S. R. FARIS, for about 10 years connected with the Western Electric Company, of Chicago, and particularly active in extending the company's business in the South, has been elected president of the newly formed Continental Electric Company, of 324 Dearborn Street, Chicago. The members of this company will be sales engineers and represent Eastern manufacturers of electrical specialties.

MR. J. FRANK DOSTAL, superintendent of the electric department of the Denver Gas & Electric Company, of Denver, Colo., has been elected director of that company to take the place of Mr. Emerson McMillin. Mr. Dostal was graduated from Purdue University eight years ago. The greater part of his work has been under the direction of Mr. W. J. Barker, general superintendent of the company.

MR. C. C. COPPIN, who recently resigned as mechanical designer in the direct-current department of the Allis-Chalmers Company, has joined the staff of the Westinghouse Electric & Manufacturing Company, in a like position. Mr. Coppin previous to his association with the Allis-Chalmers Company, was with the Bullock Company, of Cincinnati, and also connected with electrical construction work on the Panama Canal.

MR. BAYARD S. STEWART, until recently with W. S. Barstow & Company, of New York, has formed a connection with the Standard Underground Cable Company, and is now in the Chicago office of that company, assisting Mr. J. R. Wiley, manager. Mr. Stewart is a technical graduate of Williamson School, Pennsylvania. Formerly he was sales manager for the Moore Electrical Company, of Newark, N. J., but has been with Barstow & Company for the last two years.

PROF. WILLIAM C. BAUER, of Denver University, has been appointed head of the new electrical engineering course of the Northwestern University, Evanston, Ill. Prof. Bauer was appointed to the chair of physics and electrical engineering of Denver University last year. Previously he had for 10 years been a member of the faculty of Baker University, Baldwin, Kan., and at one time was instructor in civil engineering at the University of Cincinnati.

MR. F. J. DOMMERQUE, for many years on the engineering staff and secretary of the Kellogg Switchboard & Supply Company, has accepted a position with the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., as general representative, and will act exclusively in the interests of that company in an engineering and advisory capacity. Mr. Dommerque was educated at the Mathematical Institute of Zurich and the Technical University of Munich, and after a practical experience in a German steam engine works and with an English electrical manufacturing company, came to this country in 1888, and for four years was with the Western Electric Company, Thomson Electric Welding Company, United Traction Company, and in the electrical department of the Singer Manufacturing Company. Following a year passed in Europe, he entered the engineering department of the Chicago Telephone Company in 1893, from which he resigned in 1899 to join the engineering staff of the Kellogg Company, of which he became secretary in 1903. During his connection of 10 years with this company he has had charge of many lines of work, including the planning and supervision of switchboard installations, commercial engineering, supervision of the foreign patent department, etc. Mr. Dommerque has made many contributions to electrical engineering literature through the technical press and transactions of electrical societies.

Trade Publications.

OUTLET BOXES AND COVERS of galvanized stamped steel are illustrated and listed in a bulletin issued by the Pratt Chuck Company, of Frankfort, N. Y. Galvanized boxes and fittings are recommended by the Underwriters in order to secure better contact. Other features of the company's boxes are clean knock-out holes and self-adjustable covers.

WHEELER REFLECTORS.—The Wheeler Reflector Company, Boston, Mass., has issued a bulletin showing the recent additions to its line of street fixtures, which are illustrated by excellent cuts. Most of the new fixtures shown are designed for use with tungsten lamps. Accompanying the illustration of a fluted street reflector is a photometric showing the distribution of light.

AUTOMATIC DRAFT CONTROL.—Bulletin No. 121, issued by the Green Fuel Economizer Company, of Matteawan, N. Y., sets forth the advantages of the Green system of automatic draft control for steam boiler furnaces. This system unites the desirable qualities of forced draft with those of induced draft or chimney draft, and aims to maintain a neutral pressure in the furnace.

CATENARY MATERIAL.—The Ohio Brass Company, Mansfield, Ohio, has just issued an attractive catalog of its extensive line of catenary material. Every detail part used in the construction of catenary lines is illustrated and properly described, tables of dimensions, price lists, etc., being also given. On several pages are shown views of several railway lines using catenary overhead construction.

COPPER-CLAD STEEL.—The Duplex Metals Company, of New York City, has issued a small catalog setting forth the features of copper-clad steel wire. This has an average conductivity of 40 per cent of the conductivity of the same size of copper wire, while the breaking limit is very much higher. In making the wire molten copper is welded to steel and the composite billet is hot-rolled to a wire rod.

POWER PUMPS.—A well-executed catalog has been issued by the Goulds Manufacturing Company, of Seneca Falls, N. Y., on power pumps. In it the principles of the triplex power pump are discussed and various pump installations described. The company has been actively engaged in the construction of pumps and hydraulic machinery for a great many years, and naturally its output is quite extensive. The products of the

company are illustrated and listed in the catalog, which contains besides much useful information.

"GREAT ELECTRICIANS" is the title of a new "King Booklet" issued by Moses King, of New York City. It contains the portraits of 52 pioneers dating from Gilbert and Franklin and coming so far down in the immediate present as to include on the last page Acheson, Hall, Fessenden and De Forest as new men in new arts. There is a prefatory page of condensed history and a final page of electrical statistics. Each portrait has a pithy note of biography. The pamphlet is 16 pages and cover.

THE PURIFICATION OF BOILER-FEED WATER is the subject of two charts reprinted from well-known authorities upon this subject by the Harrison Safety Boiler Works, Philadelphia, Pa. The charts show that by the proper application of heat and soda ash boilers may be entirely protected from corrosion and from the formation of hard scale. Since boiler-feed water should be heated in any case, and since heating water by spraying through steam takes the place of the caustic lime or caustic soda used in other processes for taking up carbon dioxide, this hot process system is claimed to be the rational method of converting cold, hard water into hot, soft water for boiler-feed purposes. The hot process apparatus designed and built by the above company is claimed to combine all the functions of an open feed-water heater with those of a softening system, and the fact that a feed-water heater should be installed in any case thus makes it comparatively inexpensive to secure softening in addition.

Business Notes.

GUINLE & CO., the Brazilian electrical engineering firm, have removed their New York offices to 42 Broadway. As is well known, they are largely interested in hydro-electric development in the South American Republic.

THE HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, N. H., has removed its New York office from 1931 Broadway to 136 Liberty Street, where, with greatly increased space and facilities, it will be in a better position to give its rapidly growing business the best possible attention.

THE LINCOLN MOTOR WORKS COMPANY, Cleveland, Ohio, has changed its name to The Reliance Electric & Engineering Company. The management will remain the same. The company will continue the manufacture of the Lincoln variable-speed motor, but will add a complete line of constant-speed motors, and make all driving mechanisms necessary in applying the motor drive to any class of machinery.

GRIMSHAW WIRE NEW YORK STOCK ROOM.—An increased local demand for its rubber-covered wires and insulating tapes has made it necessary for the New York Insulated Wire Company to secure a new and larger stock room. This is ideally located at 80 Murray Street, in the immediate vicinity of most of the large jobbing and supply houses. The increased stock now carried in New York City enables all local, as well as out-of-town, orders to be filled the day they are received.

ELECTRIC STORAGE BATTERY SALES MANAGERS MEET.—The Electric Storage Battery Company held a convention of its sales managers at the Bellevue Stratford, on May 27, 28 and 29. An opening address was made by the president and general manager, Mr. Herbert Lloyd, and a paper was read by Mr. Charles Blizard, third vice-president and manager of the sales department. Papers were also read by Mr. J. Lester Woodbridge, chief engineer of the company; Mr. Carroll Hodge, manager of construction; Mr. Joseph Appleton, consulting engineer, and others. The following managers from the different sales offices were present: New York, Mr. Albert Taylor; Boston, Mr. Frank J. Stone; Chicago, Mr. G. H. Atkin; St. Louis, Mr. H. B. Marshall; Cleveland, Mr. H. B. Gay; Atlanta, Mr. H. H. Seaman; San Francisco, Mr. R. B. Daggett; Pennsylvania, Mr. E. L. Reynolds.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon, Mobile, Ala.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, 29 West 39th St., New York.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, New York City, 1909.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September. Annual meeting, Hotel Frontenac, Thousand Islands, N. Y., June 28, 1909.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark. Next meeting, Pine Bluff, Ark., 1910.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 557 Frick Building Annex, Pittsburgh, Pa. Next meeting, Buffalo, N. Y., June 23, 24 and 25, 1909.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

American Street & Interurban Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia. Next meeting, Denver, Col., Oct. 18-22, 1909.

American Street & Interurban Railway Engineering Association. Secretary, John S. Corning, Boston Electric Railway Company, Boston. Next meeting, Denver, Col., Oct. 18-22, 1909.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York. Next meeting, Denver, Col., Oct. 18-22, 1909.

Association of Car Lighting Engineers. Secretary, G. B. Colegrove, Illinois Central Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

Association of Edison Illuminating Companies. Secretary, D. L. Hunting, Spokane, Wash. Next meeting, Briarcliff Manor, N. Y., Aug. 31, Sept. 2, 1909.

Association of Electric Lighting Engineers of New England. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Lift Building, Toronto, Ont. Next meeting, Quebec, Can., June 16, 17 and 18, 1909.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind. Next meeting, Fort Wayne, Ind., June 3, 1909.

Colorado Electric Light, Power & Railway Association. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, Denver, Oct. 12, 1909.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electric Club, Chicago. Secretary, W. S. Taussig, 204 Dearborn St., Chicago. Meets every Wednesday noon at Chicago Automobile Club.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 500 Fifth Ave., New York.

Electrical Contractors' Association of State of Missouri. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo. Next meeting, Kansas City, June 10, 1909.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York. Next meeting, New York City, October, 1909.

Florida Electrical Association. Secretary, G. F. Doig, Gainesville, Fla.

Illinois State Electric Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, J. W. Fluckner, 503 Fifth Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Internal Combustion Engine Association. Secretary, Walter I. Sittig, 61 Ward St., Chicago.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Ia.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Sioux City, April, 1910.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October, each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 15, 1909.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, Jefferson City, Mo., April 14, 15 and 16, 1910.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 10, 1909.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, Seattle, September, 1909.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis. Next meeting, Milwaukee, January, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Lima, Ohio, Nov. 19 and 20, 1909.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburgh, Pa., 1909.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, J. T. Halloran, 604 Mission St., San Francisco, Cal. Next meeting, Oakland, Cal., February, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa. Next meeting, Sept. 7, 8 and 9, 1909.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Labanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y. Next meeting, Columbia University, New York, and Pratt Institute, Brooklyn, June 24, 25 and 26, 1909.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, care of J. G. White & Co., New York.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., Oct. 26, 27 and 28, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRIC & INTERURBAN RAILWAY ASSOCIATION. Secretary, Dudley Montgomery, Madison, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 25, 1909.

[Conducted by Wm. F. Bissing, Patent Law., 2 Rector St., N. Y. City.]

922,456. AUTOMATIC SPRINKLER SYSTEM; J. P. Casey, St. Louis, Mo. App. filed Feb. 9, 1907. For fires, for sounding an alarm when the sprinkler circuit is disabled.

922,462. TELEGRAPHY; T. B. Dixon, New York, N. Y. App. filed July 5, 1904. For multiplex telegraphy, transmitting three messages each way in which the neutral receiving instrument at each station is operated by successive current impulses which are too short to operate the ordinary receivers.

922,464. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; A. C. Eastwood, Cleveland, Ohio. App. filed Nov. 23, 1908. For protecting the windings of a motor by means of a controlling switch, a magnetically closed switch in the circuit of the motor and means for short circuiting the winding on the main switch when the switch is opened and the controlling switch is in any but off position.

922,470. ANODE ELEMENT; B. W. Gilchrist and G. L. Rice, Woodhaven, N. Y. App. filed June 9, 1908. Prolongs the life of the anode by using the scraps or pieces of anodes in a box through which the solution is free to circulate.

922,477. ELECTRIC LINE INSULATOR; R. Henry, Pueblo, Col. App. filed Oct. 5, 1908. An interior screw threaded locking cap fits on the pin and is provided with exterior bosses for holding the insulator.

922,521. SHORT CIRCUITING DEVICE FOR ELECTRIC MOTORS; C. A. Schnur, St. Louis County, Mo. App. filed May 9, 1908. Consists of an annular member of copper laminæ, which can be reciprocated to connect the individual members of the commutator.

922,531. ELECTRIC AIR HEATING AND DISCHARGING DEVICE; L. A. Siebert, Columbus, Ohio. App. filed March 28, 1908. For drying the hair. Supplies air under pressure to a small portable tank through which heating wires pass.

922,540. SYSTEM OF MOTOR CONTROL; H. F. Stratton, Cleveland, Ohio. App. filed Oct. 1, 1908. Magnetic switch controller for controlling motors by means of actuating coils and plungers, the latter operating contacts.

922,550. CLOCK WINDING MECHANISM; E. E. Yaxley, Chicago, Ill. App. filed April 2, 1908. Motors for operating clocks by means of a ratchet and pawl mechanism worked from an electromagnet.

922,556. INSULATING JOINT; A. F. Batchelder, Schenectady, N. Y. App. filed Sept. 28, 1908. For use in steam heating systems where steam is generated by passing currents through the pipe carrying the water. Comprises two heads with a tube between and means for clamping the parts together and insulating the tubes from the heads.

922,562. NOZZLE FOR ELASTIC FLUID TURBINES; J. G. Callan, Lynn, Mass. App. filed Nov. 21, 1904. The nozzle is formed of electro-deposited metal.

922,623. ATTACHING DEVICE FOR ELECTRIC FIXTURES; L. A. Parrish, Great Barrington, Mass. App. filed Feb. 1, 1909. For attaching to outlet boxes by means of a plate and collapsible locking members carried by the plate, engaging, when projected, the outlet box.

922,654. SAFETY ELECTRICAL CIRCUIT BREAKER; W. F. Wocher, R. L. Lemon and L. H. Mortsolf, Indianapolis, Ind. App. filed Feb. 19, 1908. For automobiles, to enable owner to leave machine unguarded. A conducting connector normally connects two contacts and a locking device holds the connector disconnected at will.

922,690. SPLICING SLEEVE; H. Frankel, New York, N. Y. App. filed Nov. 27, 1908. For trolley wires. A sleeve and clutch members receive the ends of the wire and hold them together.

922,726. BATTERY ELECTRODE; C. B. Schoenmehl, Waterbury, Conn. App. filed June 10, 1908. A negative electrode for primary batteries consisting of annular compressed copper oxide sections arranged one above the other.

922,727. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl, Waterbury, Conn. App. filed June 10, 1908. An electrode supporting frame having side and cross pieces overlapping the four edges of an electrode and supporting rods therefor.

922,728. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl and W. G. C. Krause, Waterbury, Conn. App. filed June 10, 1908. An electrode for batteries having a top cross-piece and braces engaging a block, the block having pockets to receive the braces.

922,729. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl and W. G. C. Krause, Waterbury, Conn. App. filed June 10, 1908. A primary battery electrode, comprising an inverted U-shaped wire frame, with sheet metal strips secured thereto and attachable to a battery cover.

922,730. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl, Waterbury, Conn. App. filed June 10, 1908. Support for primary battery electrodes formed of wire engaging an oxide plate and having its ends arranged over the top of the plate.

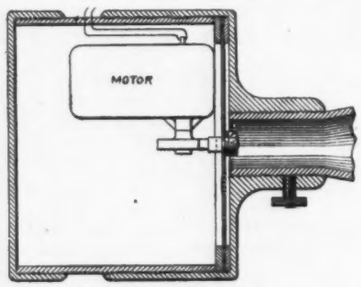
922,731. BATTERY ELEMENT SUPPORT; C. B. Schoenmehl, Waterbury, Conn. App. filed Nov. 30, 1908. A metal frame for sustaining the positive and negative plates from a battery cover within a jar. Includes a wire top with an intermediate portion having an eye for the attachment of a binding post.

922,746. ELECTRIC SWITCH; C. R. Beebe, New Haven, Conn. App. filed Jan. 11, 1909. For starting the battery for preliminary sparking. Includes a box, a switch arm, contact plates and a bifurcated key, which may be removed to cut out the sparking mechanism.

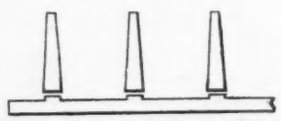
922,752. ELECTRIC TRAIN OR VEHICLE; J. L. Creveling, New York, N. Y. App. filed March 26, 1903. Fuel is carried by the train, is burned under a boiler, producing steam, which runs a turbine which drive dynamos which supply current to motors which run the train.

922,760. POLE PIECE FASTENING DEVICE; J. D. Firmin, Pleasant Ridge, Ohio. App. filed Sept. 14, 1905. For fastening laminated pole pieces to fields by means of bolts, which are anchored in the pole piece.

923,024.—Lightning Arrester.



923,122.—Mechanically Actuated Diaphragm Horn or Alarm.



923,128.—Process of Electric Welding.

922,781. PRINTING TELEGRAPH; I. Kitsee, Philadelphia, Pa. App. filed Aug. 25, 1908. Synchronism between transmitting and receiving apparatus is not necessary, the latter being controlled by a cable relay, which controls master intermittent mechanisms, each of which controls a plurality of printing surfaces.

922,780. CABLE RELAY; I. Kitsee, Philadelphia, Pa. App. filed Aug. 8, 1907. For submarine cable work. To avoid the shifting zero in a siphon recorder. The relay has two moving coils and each carries a movable contact.

922,794. ROTOR CONSTRUCTION; E. Mattman, Norwood, Ohio. App. filed May 31, 1907. Comprises a spider, a rim, and skewed fan blades around the rim for ventilating.

922,800. PROCESS IN MAGNETIC SEPARATION; W. B. Moore, Seattle, Washington. App. filed Aug. 31, 1906. Feeds the mass of material into a magnetic field and magnetically impels the extracted particles across a passageway, where they are subjected to a rapid reversal of polarity in a stream of water.

922,801. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed Nov. 9, 1908. A fused case-holder, having an upper member, a lower member with an opening, and a removable fuse case in the opening.

922,802. POWER TRANSMITTING DEVICE; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 27, 1908. Uses a clutch mechanism under the control of an electromagnet, for transmitting the movement.

922,823. MULTIPLE VOLTAGE CONTROLLER; E. W. Stull, Norwood, Ohio. App. filed Oct. 31, 1906. A drum controller, with suitable contacts so as to throw the motor from one set of mains to another without interrupting the circuit through the action of a translating device.

922,825. OIL SWITCH; H. L. Van Valkenburg, Norwood, Ohio. App. filed Aug. 25, 1905. A four-brake single-pole switch, having four rods with a movable oil tank operated by a lever for raising and lowering the tank.

922,839. DYNAMO ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed June 5, 1905. Direct current machine, provided with a compensating winding and a commutation winding, to avoid sparking.

922,849. INDICATOR FOR AUTOMATIC ELEVATOR SYSTEMS; A. H. Buckelew, Newark, N. J. App. filed March 29, 1907. A push-button controlled elevator, with an indicator to give the position of the car and the condition of the circuits.

922,883. ALARM SYSTEM; L. Giese, Fort Worth, Texas. App. filed July 16, 1908. A fire alarm system having a mercury circuit closer of particular construction.

922,917. ELECTRIC TERMINAL; G. C. Landis, York, Pa. App. filed April 3, 1907. For attaching a carbon electrode to the terminal, the terminal being cup shaped and hollow so that water may blow through it to keep it cool.

922,924. DYNAMO ELECTRIC MACHINE; C. E. Lord, Norwood, Ohio. App. filed May 3, 1906. For high-speed turbo generators, with means for ventilating them. The stator has parallel ventilating openings, which are blocked by laminæ of magnetic material at the inner periphery of the core.

922,946. DYNAMO ELECTRIC MACHINE; W. D. Pomeroy, Norwood, Ohio. App. filed July 27, 1906. For high speed turbo alternators. A ring prevents the end turns from being displaced by centrifugal force, and is provided with slots to make it expansible and to secure ventilation.

922,951. THIRD-RAIL INSULATOR; L. M. Randolph, Newark, N. J. App. filed May 2, 1907. Comprises a short section of channel iron, a short section of an I beam, and insulating material between them.

922,956. DEVICE FOR PREVENTING DOG NUISANCE; A. H. Roberts, Waverly, N. Y. App. filed Dec. 26, 1907. An electric guard for shocking dogs.

922,977. ROSETTE; E. Tregoning, Attleboro, Mass. App. filed Nov. 6, 1908. Electrical rosette for supporting lamps, having a base with a removable cap, and two strain receiving members overlying the boss formed on the base.

923,018. ELECTRIC FURNACE; F. M. Chaplet, Laval, and A. Remond, Paris, France. App. filed March 19, 1907. Furnace has two distinct compartments with a communicating passage. The open compartment receives a carbon electrode and the closed compartment receives an electrode, forming an arc with the molten metal.

923,020. DEVICE FOR AUTOMATICALLY STOPPING VEHICLES; S. H. Cluxton, Washington, D. C. App. filed Jan. 5, 1907. Makes use of electromagnets below the rails, which magnetizes the rails and causes the wheels to stick so as to check the speed of the train.

923,024. LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed July 9, 1906. A high-voltage lightning arrester, including a discharge path, consisting of electrolytic condensers connected to a common point, the condenser plates being of aluminum.

923,033. TELEGRAPH TRANSMITTER; T. J. Dunn, Jersey City, N. J. App. filed Dec. 31, 1908. The transmitter includes a horizontal vibrator, a vertical plunger, and a pair of electrical contacts, one carried by the vibrator and the other fixed.

923,035. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Jan. 20, 1902. Exchanges connected by trunk lines and employing clearing out signals. The hanging up of the receiver by the called subscriber lights two lamps, one at the switchboard of the trunking operator and the other at the originating operator's exchange.

923,071. ELECTRICAL CONNECTOR; G. E. Palmer, Boston, Mass. App. filed Nov. 21, 1906. A clip to embrace a pipe, one end having a wire receiving socket and the other bearing against the middle of the socket, with bolt and nut passing through the free ends to draw them together.

923,114. FIRE ALARM TELEGRAPH APPARATUS; F. W. Cole, Newton, Mass. App. filed Oct. 24, 1908. A signal box, with circuits for transmitting a drill signal and a fire alarm signal.

923,115. FRANGIBLE PROTECTING DEVICE; F. W. Cole, Newton, Mass. App. filed Oct. 27, 1908. For fire alarm boxes, in which a self-opening door with a glass plate and shield back of the plate are so arranged that the shield prevents the broken glass from entering the opening into the box.

923,122. MECHANICALLY ACTUATED DIAPHRAGM HORN, OR ALARM; M. R. Hutchison, Summit, N. J. App. filed March 14, 1906. Provides a case and resonator with a diaphragm and motor, the latter driving a cam which vibrates the diaphragm.

923,124. MERCURY OR OTHER VAPOR ELECTRIC LAMP; H. A. Kent, Bounds Green, and H. G. Lacell, Finchley, England. App. filed Oct. 3, 1908. A tube made of quartz glass contains mercury, which is vaporized in the tube, forming an arc and pressing back the liquid mercury which slowly passes through the tube, preserving a steady arc.

923,127. ELECTRIC ARC LAMPS; L. O. Kozar, Wilkes-Barre, Pa. App. filed March 17, 1909. For use with electric arc lamps to limit the separation of the electrodes by means of a dash pot, which tends to prevent their separation, and a spring secured to a dash pot, which is placed under tension when the electrodes move toward each other.

923,128. PROCESS OF ELECTRIC WELDING; M. Lachman, of New York, N. Y. App. filed Oct. 17, 1906. For electrically welding the end of one piece of metal to the flat surface of another by first providing the flat piece with a spur or lug of less cross section than the tooth to be welded to it, thus localizing the heat in the spur.

923,129. ELECTRIC SWITCH; E. O. Schweitzer and A. Herz, Chicago, Ill. App. filed July 19, 1906. An electric light snap switch, with an hour glass containing mercury, so that when the switch is operated the lights remain lighted until the mercury flows through the hour glass, which automatically extinguishes the lights.